National Park Service
U.S. Department of the Interior

**Lake Chelan National Recreation Area**

# Stehekin River Corridor Implementation Plan and Final Environmental Impact Statement • Volume I

North Cascades National Park Service Complex
Lake Chelan National Recreation Area
July 2012

**Early Morning on Lake Chelan (John Chao).**

# Stehekin River Corridor Implementation Plan
# Final Environmental Impact Statement

Lake Chelan National Recreation Area

**Prepared by:** North Cascades National Park Service Complex, Pacific West Region, National Park Service, U.S. Department of the Interior
**Lead Agency:** National Park Service, U.S. Department of the Interior
**Cooperating Agency:** Federal Highway Administration, U.S. Department of Transportation

## ABSTRACT


Because of the current impacts and future risks associated with unprecedented flooding and channel changes on the lower Stehekin River within Lake Chelan National Recreation Area (NRA), the primary purposes of the alternatives are to: sustainably operate and maintain National Park Service (NPS) administrative facilities, public access (roads and trails), and campgrounds; protect water quality, scenic values, habitat, and natural processes of the Stehekin River; and to partner with the Stehekin Community to provide services, facilities and experiences for visitors. This plan would enable the NPS to meet the goals and direction provided in the 1995 Lake Chelan NRA General Management Plan (GMP).

This implementation plan is needed to address the following interrelated issues: (1) respond to the increased magnitude and frequency of flooding, (2) implement and clarify 1995GMP guidance, (3) sustain public facilities while protecting natural resources, (4) manage limited funding, and (5) respond to private landowners.

***Alternative 1 (No Action): Continue Current Management Practices and Existing Plan Implementation:*** Maintain the Stehekin Valley Road in its current alignment. Raise it through McGregor Meadows. Relocate administrative facilities out of the floodplain. Continue to implement 1995 Land Protection Plan (LPP) priorities. Implement erosion protection measures initially at one site.

***Alternative 2: At-Risk Public Facilities Removed from Channel Migration Zone Where Possible; More Priority Land Exchange/Acquisition in Channel Migration Zone (Environmentally Preferable):*** Reroute the Stehekin Valley Road out of the channel migration zone around McGregor Meadows and the Lower Field. Relocate administrative facilities (maintenance and housing) out of the floodplain, near the airstrip. Identify new land protection priorities through a revised LPP. Implement erosion protection measures at three sites.

***Alternative 3: At-Risk Public Facilities Removed from Channel Migration Zone in Most Areas; Same Land Protection Plan as Alternative 2:*** Reroute the Stehekin Valley Road out of the channel migration zone only around McGregor Meadows. Relocate administrative facilities out of the floodplain, near the airstrip. Identify new land protection priorities through a revised LPP. Implement erosion protection measures at five sites.

***Alternative 4: At-Risk Public Facilities Removed from Channel Migration Zone in Some Areas; Less Priority Land Exchange / Acquisition in Channel Migration Zone:*** Maintain the existing alignment of the Stehekin Valley Road. Raise it through McGregor Meadows. Relocate administrative facilities out of the floodplain, near the airstrip. Identify new land protection priorities through a revised LPP (differently than in Alternatives 2 and 3). Implement erosion protection measures at seven sites.

***Alternative 5: At-Risk Public Facilities Removed from Channel Migration Zone Where Possible; Priority Land Exchange/Acquisition in Most Vulnerable Areas (NPS Preferred):*** This alternative modifies Alternative 2 based on DEIS public comments. Provide a connecting road from the reroute to McGregor Meadows. Identify LPP priorities based on revised criteria that focus primarily on flood and erosion threats. Relocate maintenance facilities near the airstrip and housing in the lower valley. Other minor changes from Alternative 2 are also called for.



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**Lake Chelan Reflections (John Chao).**

# Lake Chelan National Recreation Area

## *Stehekin River Corridor Implementation Plan and Final Environmental Impact Statement • Volume I*

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# CHANGES BETWEEN DRAFT AND FINAL ENVIRONMENTAL IMPACT STATEMENT

In response to public comments on the DEIS, the following changes have been made in the FEIS:

- An Alternative 5 was added in the FEIS as a modified version of Alternative 2. This alternative includes:
    - A Reroute Access Connector (a 940 - 1,200 foot long road that would connect the Alternative 2 reroute with the McGregor Meadows area) across public and private land.
    - Revisions to the Land Protection Plan, including modifications to the LPP criteria for determining priority interest in parcels within the most vulnerable areas (floodplain / channel migration zone in McGregor Meadows and near the Stehekin River mouth and debris flow hazard zones) and to add scenic criteria near the head of the lake that resulted in a revised tract priority list for Alternative 5.
    - Different locations where future employee housing could be considered in the lower valley.
    - Adjustments to the proposed route and use of the Lower Valley Trail.
    - The potential for several grade control structures to be constructed through public-private partnerships to improve the ability to retain the McGregor Meadows Access Road.
    - A box culvert, rather than a low water crossing, at Milepost 8.5 to improve bicycle access.
    - Other modifications to reduce overall impacts.
- The socioeconomics section in Chapter III: Affected Environment and Chapter IV: Environmental Consequences was updated. The section in Chapter III also expands the discussion beyond those areas that could be impacted by the proposed actions in Alternatives 1-5.
- One of the purpose statements, the alternative titles, and the statement describing the Federal Highway Administration as a cooperating agency were changed slightly.
- Based on additional (75 percent) design by FHWA, changes were incorporated in the proposed design of the roadway components of the alternatives.
- Based on additional design by the NPS, erosion protection measures were modified.
- The sections “Impact Topics Dismissed from Further Consideration” and “Alternatives and Actions Considered but Dismissed” were modified.
- The Floodplains Statement of Findings was combined with a new Wetlands Statement of Findings.
- Several appendices were modified, including Appendix 8: Vascular Plants Observed within Proposed Project Areas and Appendix 19: Carbon Emission Estimates and Calculations.
- Several appendices were added, including Appendix 20: USFWS Biological Opinion, Appendix 21: NPS Response to Comments on the DEIS, and Appendix 22: Agency, Organization and Business Comment Letters.
- New environmental impact analysis for Alternative 5 was added to the FEIS.
- Some modifications were made to the environmental impact analysis of Alternatives 1 - 4 based on additional design by FHWA and for consistency with the USFWS Biological Opinion.
- Some modifications to the environmental impact analysis were also made to include new or expanded information provided by resource specialists from North Cascades NPS Complex and/or to clarify the extent of impacts.
- Changes / additions were made to Chapter V: Consultation and Coordination to update addresses, individuals, businesses, and organizations and to update sections referring to consultation on the FEIS, including a description of the DEIS comment process and a summary of comments.
- Editorial changes were made throughout the FEIS to clarify previous language and to improve descriptions of proposed alternative components and analysis.
- Maps and figures were revised to improve accuracy of descriptions.
- Minor editorial changes were made to reduce the number of missing or wrong words and typographical errors.

# HOW THIS FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) IS ORGANIZED

This FEIS is organized in two volumes. Volume I contains the following sections and/or chapters.

1. **Table of Contents**
   This lists the chapters and primary subsections of each and where they may be found within the document.

2. **Executive Summary**
   This section contains a summary of the main sections of this FEIS.

3. **Chapter I: Purpose of and Need for Management Action**
   This chapter identifies the purpose and need for the proposed actions. It also introduces Lake Chelan NRA, the project area, and the planning background for the project, including the purpose and significance of Lake Chelan NRA. It identifies related laws, policy, and park and other agency plans, and summarizes public participation. "Impact Topics" describes the potentially affected resources and laws or policy relating to their inclusion in the FEIS. This section also identifies those resources that have been dismissed from further analysis due to their having no or negligible identified potential environmental consequences.

4. **Chapter II: Management Alternatives**
   This chapter describes the proposed alternative courses of action, including the reasons for dismissing options that do not meet project objectives or other defined criteria. It also identifies and provides analysis related to he selection of the environmentally preferable alternative. The alternative comparison chart (Table i-1) highlights the major impacts among the alternatives.

5. **Chapter III: Affected Environment**
   "Affected Environment" provides information about the existing environment, focusing primarily on those resources that could be affected by the decisions in the alternatives.

6. **Chapter IV: Environmental Consequences**
   This chapter describes the impacts of each alternative on Lake Chelan NRA resources, including cumulative impacts. "Methodology" introduces key background material for the analysis presented in the "Environmental Consequences" section. Similar to Chapter II: *Management Alternatives,* the "Environmental Consequences" section contains an impact comparison chart (Table IV-16) to compare the differences in projected impacts among the alternatives.

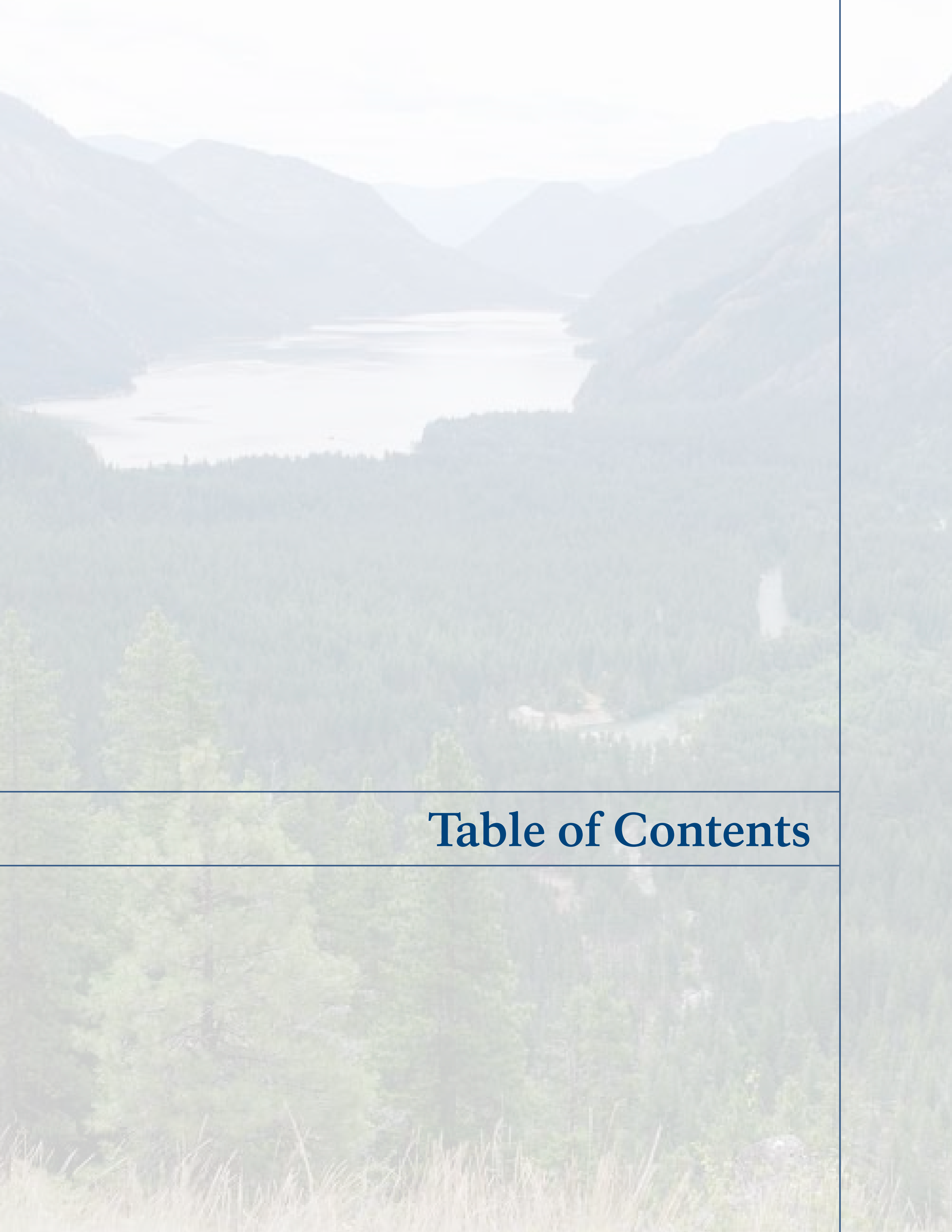
7. **Chapter V: Consultation and Coordination**
   This chapter summarizes information about internal and public scoping and preparation and review of the FEIS and includes a list of preparers, identifying agencies, and individuals consulted during the planning process.

8. **Chapter VI: References**
   This chapter provides bibliographical information for sources cited in this FEIS.

9. **Chapter VII: Glossary and Acronyms**
   This chapter provides definitions for acronyms and technical terms used in this FEIS.

Volume II includes the Appendices which provide information and documents that support the analysis and information within the *Stehekin River Corridor Implementation Plan and Final Environmental Impact Statement*. This volume includes the following appendices:

- **Appendix 1:** Lake Chelan National Recreation Area Enabling Legislation (Public Law 90-544);
- **Appendix 2:** Management Objectives and Actions in the Lake Chelan NRA GMP Applicable to the SRCIP;
- **Appendix 3:** Lake Chelan National Recreation Area Land Protection Plan Management Goals / Objectives and Guidelines;
- **Appendix 4:** Stehekin River Reach Analysis;
- **Appendix 5:** Cumulative Impacts Project List;
- **Appendix 6:** Summary of Mitigation Measures;
- **Appendix 7:** Army Corps of Engineers (ACOE) Advanced Flood Protection Measures;
- **Appendix 8:** Vascular Plants Observed within Proposed Project Areas;
- **Appendix 9:** Proposed Conditions, Covenants and Deed Restrictions (CCRs);
- **Appendix 10:** 1995 Land Protection Plan Ranking of Private Lands;
- **Appendix 11:** Alternatives 2 and 3 Proposed Ranking of Private Lands for the Revised Land Protection Plan (2010);
- **Appendix 12:** Alternative 4 Proposed Ranking of Private Lands (2010);
- **Appendix 13:** Alternative 5 Proposed Ranking of Private Lands for the Revised Land Protection Plan (2012);
- **Appendix 14:** Revised 2010 Land Protection Plan (detached);
- **Appendix 15:** Laws, Regulations, and Policies Whitepaper;
- **Appendix 16:** Current Knowledge Base Whitepaper (detached);
- **Appendix 17:** Draft Wetlands and Floodplains Statement of Findings;
- **Appendix 18:** Estimates of Gravel Accumulation in Two Reaches of the Stehekin River;
- **Appendix 19:** Carbon Emission Estimates and Calculations;
- **Appendix 20:** USFWS Biological Opinion;
- **Appendix 21:** NPS Responses to Comments on the DEIS; and
- **Appendix 22:** Agency and Organization DEIS Comment Letters.



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View of Stehekin from Rainbow Loop Trail.

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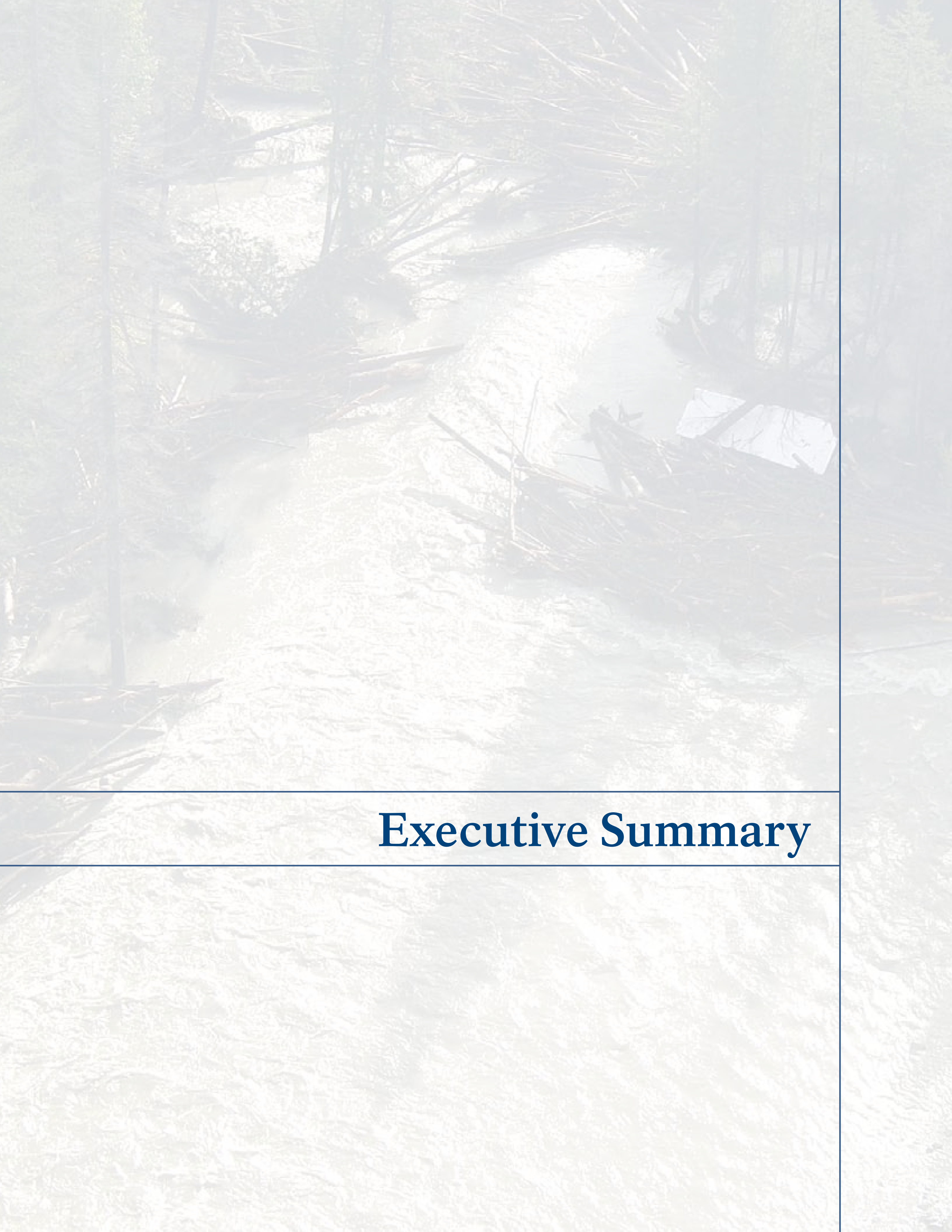


# Executive Summary

**Private cabin, well, and septic system incorporated into logjam at McGregor Meadows during 2003 flood.**

# EXECUTIVE SUMMARY

This Final Environmental Impact Statement (FEIS) analyzes a range of alternatives (management actions) to respond to the increased magnitude and frequency of flooding in the Stehekin River corridor within Lake Chelan National Recreation Area (Lake Chelan NRA). The differences among the alternatives are primarily related to the way different management strategies are applied. These strategies are focused on the floodplain / channel migration zone, land use, and land exchange / acquisition.

Alternatives 1 - 5 are based on the purpose and need for the project and conform to existing laws, policies, and planning documents, including the National Park Service (NPS) Omnibus Management Act (Public Law 105-392) and the Lake Chelan NRA General Management Plan / Environmental Impact Statement (GMP/EIS) (NPS LACH 1995a). Alternative 5 is identified as the agency-preferred alternative, while Alternative 2 is identified as the environmentally preferable alternative. Alternative 5 is a modification of Alternative 2 in response to public comments. It is also updated based on additional design modifications.

The NPS is the lead agency in the development of this Environmental Impact Statement (EIS) and has identified a need to evaluate comprehensive and sustainable management strategies and linked public-private actions to address the consequences of flooding. The Federal Highway Administration (FHWA) is a cooperating agency because the proposed action involves funds for which the FHWA is responsible and roadway construction for which the FHWA is providing technical expertise and construction contract administration services. All alternatives involve various treatments of the Stehekin Valley Road, for which the FHWA would provide the necessary funding, design, and construction expertise.

This FEIS has been prepared to satisfy the requirements of the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190, 42 U.S. C. 4321 - 4347, as amended), including the Council on Environmental Quality (CEQ) regulations found at 40 CFR 1500 - 1508 and other applicable laws; NPS *Management Policies 2006* (NPS 2006a); the NPS NEPA *Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making* (Director's Order 12) and handbook (NPS 2001a); and other management directives. This FEIS facilitates compliance with Section 106 of the National Historic Preservation Act and its implementing regulations (36 CFR Part 800), Section 7 of the Endangered Species Act, and other applicable laws and executive orders enacted for the protection of the environment.

Following publication of the availability of this FEIS in the Federal Register, it will be used to prepare a Record of Decision for the proposed action (whichever alternative [or parts thereof] is selected).

## A. PROJECT AREA LOCATION

The project area includes the lower Stehekin Valley, from High Bridge to the head of Lake Chelan, including Weaver Point. No actions are considered in the adjacent wilderness that begins above about 1,640 feet elevation, about 400 feet above the floor of the lower valley (Figure i-1: *Project Area—Lower Stehekin Valley* and Figure i-2: *Existing Conditions*).

**Figure i-1: Project Area – Lower Stehekin Valley**

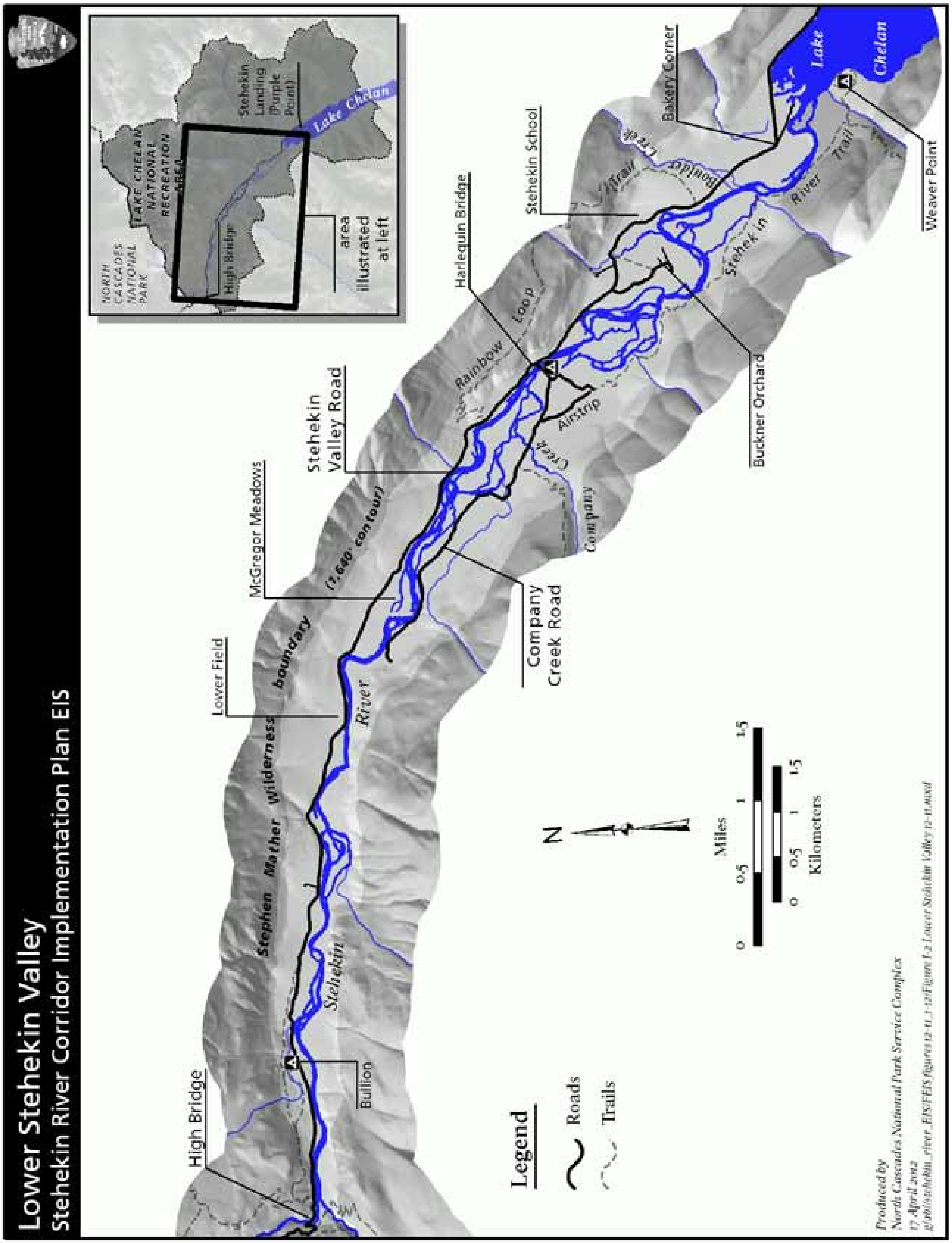
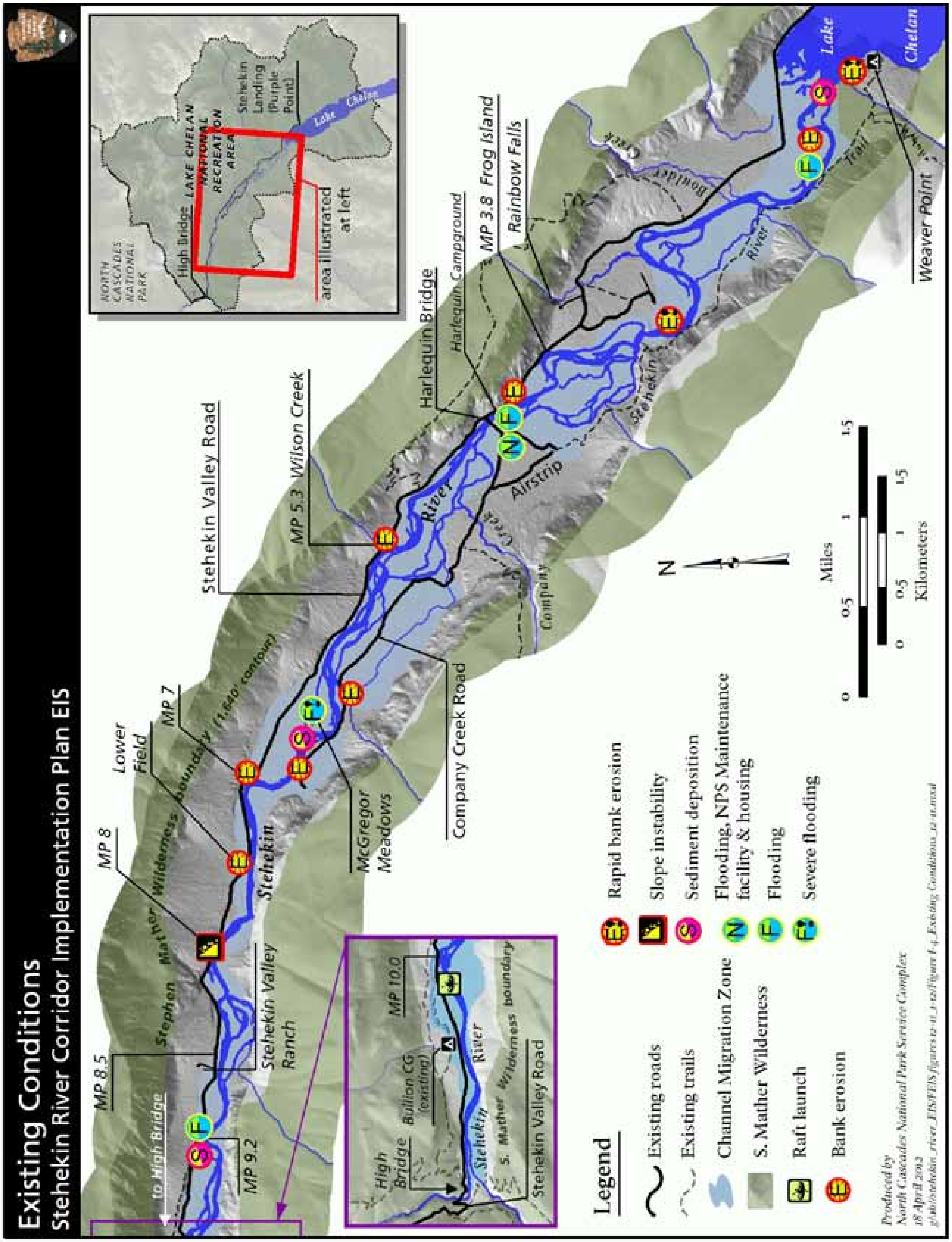


**Figure i-2: Existing Conditions**



# B. SUMMARY: PURPOSE OF AND NEED FOR MANAGEMENT ACTION

Recent major floods and resultant channel changes on the lower Stehekin River have intensified flood and erosion threats to NPS facilities and are impacting natural resources within Lake Chelan NRA. The three largest recorded floods on the Stehekin River since 1911 have occurred within the past 16 years, and in response, the NPS has spent more than $3 million to protect public roads and facilities and to repair flood damage. Roads, visitor facilities, and private development once thought to be safe from the river are now threatened. Because of the current impacts and future risks associated with these unprecedented conditions, the primary purposes of the proposed actions within this Stehekin River Corridor Implementation Plan / Environmental Impact Statement (SRCIP/EIS) are to:

- Sustainably operate and maintain NPS administrative facilities, public access (roads and trails), and campgrounds;
- Protect water quality, scenic values, habitat, and natural processes of the Stehekin River; and
- Partner with the Stehekin Community to provide services, facilities and experiences for visitors.

These purposes meet the goals and direction provided in the 1995 *Lake Chelan National Recreation Area Final General Management Plan Environmental Impact Statement* (GMP) (NPS LACH 1995a). This implementation plan is needed to address several interrelated issues, which are to (1) respond to the increased magnitude and frequency of flooding, (2) implement and clarify 1995 GMP guidance, (3) sustain public facilities while protecting natural resources, (4) manage limited funding, and to (5) respond to private landowners.

## 1. Primary Issues

### Respond to the Increased Magnitude and Frequency of Flooding.

Prior to the late 20th century, the Stehekin River was prone primarily to spring snowmelt flooding (Figure i-3*: Magnitude and Timing of the Annual Peak Flood on the Stehekin River*). Since the 1970s, however, the Stehekin River has become prone to large fall rain-on-snow floods, which rise quickly and occur from mid-October through December. Hydrologic data collected on the river since 1911 confirm the significance of this shift, as analyzed by the U.S. Geological Survey. The severe floods in 1995, 2003, and 2006 have led to significant changes in the Stehekin River channel, and redefined the boundaries for the 100-year flood. As a result, recreational and administrative facilities and developments once thought to be safe from the river are now threatened by flooding and bank erosion, while other sites in the floodplain have been compromised by larger, more frequent floods. Until now, the NPS has addressed problems on a case-by-case basis throughout the valley with the passage of each of these large floods.

### Implement and Clarify 1995 Lake Chelan NRA GMP Guidance.

The GMP provides broad management guidance for Lake Chelan NRA, as well as some specific prescriptions to mitigate the risks and consequences of flooding (NPS LACH1995a). As a

**Figure i-3: Magnitude and Timing of the Annual Peak Flood on the Stehekin River**

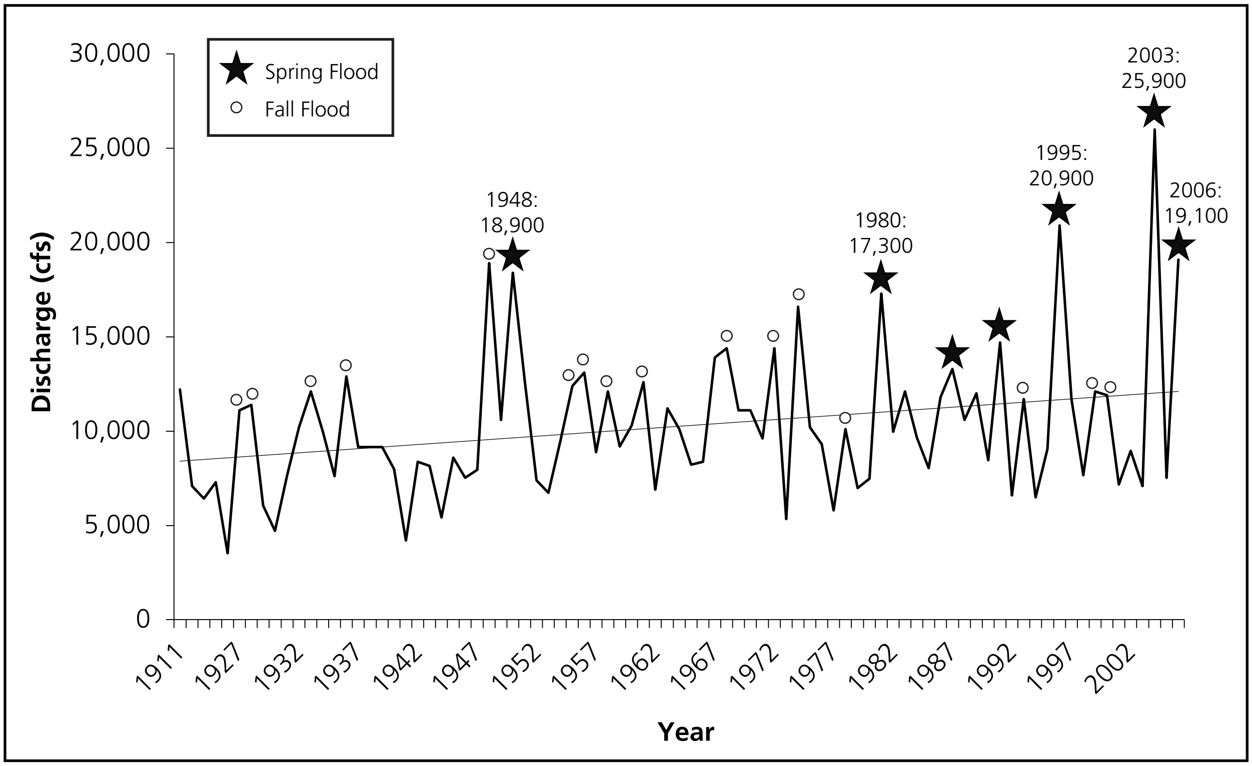



Photo 1 – Private cabin, well, and septic system incorporated into logjam at McGregor Meadows (2003).

programmatic document, the GMP lacks the specific management direction needed to respond to the current circumstances imposed by the recent floods. Specific actions called for in the GMP that would be implemented in this plan include replacement and relocation of the maintenance facility and NPS housing out of the floodplain (NPS Tracts 06-118, 06-104, 06-121, and 06-122), construction of the Lower Valley Trail and continued maintenance of vehicle access on the Stehekin Valley and Company Creek roads. This implementation plan is needed to inform the location, design, construction, and implementation of these actions. Guidance provided by the GMP needs to be updated and clarified to reflect the dramatic increase in woody debris since 1995 and recognition of the influence of Chelan County Public Utility District (Chelan PUD) operations for power generation on the level of Lake Chelan and the lower Stehekin River. This plan is also needed to evaluate and publicly disclose the direct, indirect, and cumulative impacts of proposed actions on the resources and values of Lake Chelan NRA.

## Sustain Public Facilities While Protecting Natural Resources.

Management action is needed to provide long-term use and access to administrative and recreation facilities. Despite erosion protection and flood protection efforts by the NPS and private landowners, bank erosion continues to threaten public and private property. Channel changes initiated by the large floods have increased the rate of erosion and frequency of flooding at some sites, while decreasing erosion rates at others. Integrated management actions such as facility replacement and relocation, site-specific bank hardening, and limited manipulation of woody debris in the Lake Chelan backwater zone now need to be considered to ensure the long-term sustainability of infrastructure and protection of resources. Management of large wood and proliferation of bank-protection measures have the potential to impact federally- and state-listed species and to increase the spread of nonnative plants. These conditions underscore the need for updated assessment of erosion and flood protection measures in the lower Stehekin Valley.

## Manage Limited Funding.

The NPS has spent more than $3 million to react to recent flood damage to maintain vehicle access on the Stehekin Valley and Company Creek roads and to respond to new threats on an event-by-event basis. A comprehensive and integrated set of strategies and tactics to meet the goals of the GMP and to mitigate the risk and impacts from flooding is urgently needed to enable the NPS to use limited funds for the maximum benefit of Lake Chelan NRA. Without this comprehensive approach, the NPS would continue to respond on a case-by-case basis, which costs more and could threaten natural resources and public safety.

## Respond to Private Landowners.

Lake Chelan NRA includes approximately 417 acres of private land, much of which lies within the floodplain and channel migration zone of the Stehekin River. (The channel migration zone is where the river has historically migrated in the valley over the past 1,000 years.) Developments at McGregor Meadows and near the river mouth are particularly vulnerable because of their density and their location in more active river reaches. These reaches, or sections of the river, have extensive new gravel deposits and rapidly growing logjams as a result of recent floods. The high monetary and environmental costs of bank-protection and flood-mitigation measures continue to threaten long-term sustainability of Lake Chelan NRA resources and private property. At the river mouth, the accumulation of logs in the backwater zone of Lake Chelan has led to deeper floodwater in parts of the floodplain. The recent flooding has hastened channel migration; damaged or destroyed several cabins; incorporated debris and effluent from septic systems into the river; and increased the flood risk to private lands previously not threatened by flooding. The NPS is concerned that these circumstances will continue to adversely affect Lake Chelan NRA and Stehekin River natural resources and values. The primary means by which the NPS can address this concern is through the *Lake Chelan National Recreation Area Land Protection Plan* (LPP) (NPS LACH 1995b). The LPP identifies and prioritizes private lands for acquisition or exchange from willing sellers. Last updated in 1995, the plan is being revised through this FEIS to address new river-channel and floodplain conditions and to create new funding opportunities to help protect Lake Chelan NRA and the Stehekin Community.

## 2. Decision to be Made

NEPA requires the documentation and evaluation of potential impacts resulting from federal actions on lands under federal jurisdiction. An EIS discloses the potential environmental consequences of implementing the proposed action and other reasonable and feasible alternatives. NEPA is intended to provide decision makers with sound knowledge of the environmental consequences of the alternatives available to them. In this case, the superintendent of Lake Chelan NRA (North Cascades NPS Complex) and the Pacific West Regional Director are faced with deciding which alternative to implement from the SRCIP to most effectively implement the 1995 GMP, and to meet the goals of this plan.

Photo 2 – Rafters on the Stehekin River.

## 3. Background

This SRCIP / FEIS is a response to the effects of the increased frequency and magnitude of flooding on the Stehekin River and the adverse effects this flooding has had on NPS infrastructure and private lands in the lower Stehekin Valley.

The following key characteristics of the Stehekin Valley require careful planning to avoid the effects of repeated flood damage:

1. The flood prone nature of the Stehekin River, which is due to its geography, watershed shape, and steep slopes, and because of the potential for the formation and sudden failure of debris dams in the narrow canyons above High Bridge;
2. Channel instability from the transport of large amounts of water, gravel, and large wood;
3. A shift in the last 30 years from spring floods to larger, more frequent, fall floods; and
4. A history of river manipulation, including the Lake Chelan Dam, and the addition of erosion protection measures to the river over the last 20 years—riparian resources and water quality have been adversely affected as destroyed cabins, effluent from septic systems, and other debris are incorporated into the river during floods.

# C. SUMMARY: MANAGEMENT ALTERNATIVES

The following description summarizes the differences among the management alternatives. A detailed comparison of the alternatives is found in Chapter II: *Management Alternatives* and in Table II-1: *Alternative Comparison Chart*. Illustrations of the alternatives are found in Figures i-4 through i-10.

The FEIS analyzes the potential environmental impacts that could result from the alternatives considered, including:

- Alternative 1 (No Action): Continue Current Management Practices and Existing Plan Implementation
- Alternative 2: At-Risk Public Facilities Removed from Channel Migration Zone Where Possible; More Priority Land Exchange / Acquisition in Channel Migration Zone (Environmentally Preferable)
- Alternative 3: At-Risk Public Facilities Removed from Channel Migration Zone in Most Areas; Same Land Protection Plan as Alternative 2
- Alternative 4: At-Risk Public Facilities Removed from Channel Migration Zone in Some Areas; Less Priority Land Exchange / Acquisition in Channel Migration Zone
- Alternative 5: At-Risk Public Facilities Removed from Channel Migration Zone Where Possible; Priority Land Exchange / Acquisition in Most Vulnerable Areas (NPS Preferred)

Alternatives 1-4 were described in the SRCIP DEIS. Alternative 5 is a modification of Alternative 2 based on public comments on the DEIS. It incorporates changes suggested by these public comments, including providing access to McGregor Meadows from the proposed reroute as part of plan actions now, rather than later when existing access is damaged. The existing access road and some driveways would be reinforced in Alternative 5. It also responds to comments on Land Protection Plan priorities to focus on protecting the most vulnerable areas from flood-related impacts. Alternative 5 also offers a slight realignment of the Lower Valley Trail. Other slight modifications, such as a mechanically stabilized earth (MSE) wall, have been added to further reduce impacts from the proposed reroute. In addition, future proposed administrative housing could also be constructed throughout the lower valley rather than only in conjunction with the relocated maintenance facilities as described in Alternatives 1 - 4.

## 1. Introduction

All action alternatives are based upon the concept of floodplain utilization to varying degrees. Floodplain utilization is embraced in this plan as the best approach for managing a flood-prone mountain river. This concept allows floodwaters to occupy the floodplain to achieve the benefits of slower, shallower flood water for all areas and is a sustainable approach over the long term. Proposed land use decisions would be based on the channel migration zone (CMZ) of the Stehekin River. The CMZ is defined as the area where the Stehekin River has migrated in the past 1,000 years. Unlike hydraulic model-based floodplain maps, which provide static views of floodplains and are costly, the CMZ provides a more accurate view of the dynamic floodplains associated with steep mountain rivers like the Stehekin.

Consistent with past public-private partnerships on both sides of the river at McGregor Meadows and elsewhere in the valley, this plan identifies new management strategies in partnership with private landowners where public and private concerns overlap. Therefore, the action alternatives attempt to develop sustainable linked public-private actions. Past integrated actions undertaken by the NPS include private-public partnerships to maintain floodplain utilization in McGregor Meadows (1998), the “1948” channel (2007), and upper Company Creek Road (2007). In this plan, integrated solutions to erosion and floodplain utilization include the proposed actions at Boulder Creek and the Stehekin River Mouth, and using the LPP revision to focus on the sites that are most threatened by the river.

For public land, Alternatives 2 - 5 attempt to avoid the channel migration zone, rather than only the 100-year floodplain. The reasons for using this more conservative approach include observed rapid changes in Stehekin floodplain boundaries during large floods; the high cost of computer models to determine flood elevations; and the inaccuracy of the models.

The alternatives conform to Lake Chelan NRA policies in the Lake Chelan GMP, which call for removing public and administrative facilities from the floodplain. Options for private development in the floodplain include exchange of land with the NPS, purchase of private property out of the floodplain, elevating cabins, or construction of a variety of physical features to reduce the impacts of flooding (see Appendix 7: *Army Corps of Engineers (ACOE) Advanced Flood Protection Measures*). Other alternatives, such as construction of additional levees or dikes or dredging, were considered but were dismissed because they would have unacceptable impacts on the Stehekin River floodplain, would have more ecological damage, or would require repeated, costly management actions (see “Alternatives and Actions Considered but Dismissed” below; “D. Alternatives and Actions Considered But Dismissed”in Chapter II and Appendix 18: *Estimates of Gravel Accumulation in Two Reaches of the Stehekin River*).

## 2. Summary of Actions Common to All Alternatives (1 - 5)

Several actions in this plan are common to all Alternatives (1 - 5) because they were identified in the GMP. These actions would also protect public facilities or support the concept of floodplain utilization (Figure i-4: *Major Actions Common to All Alternatives*).

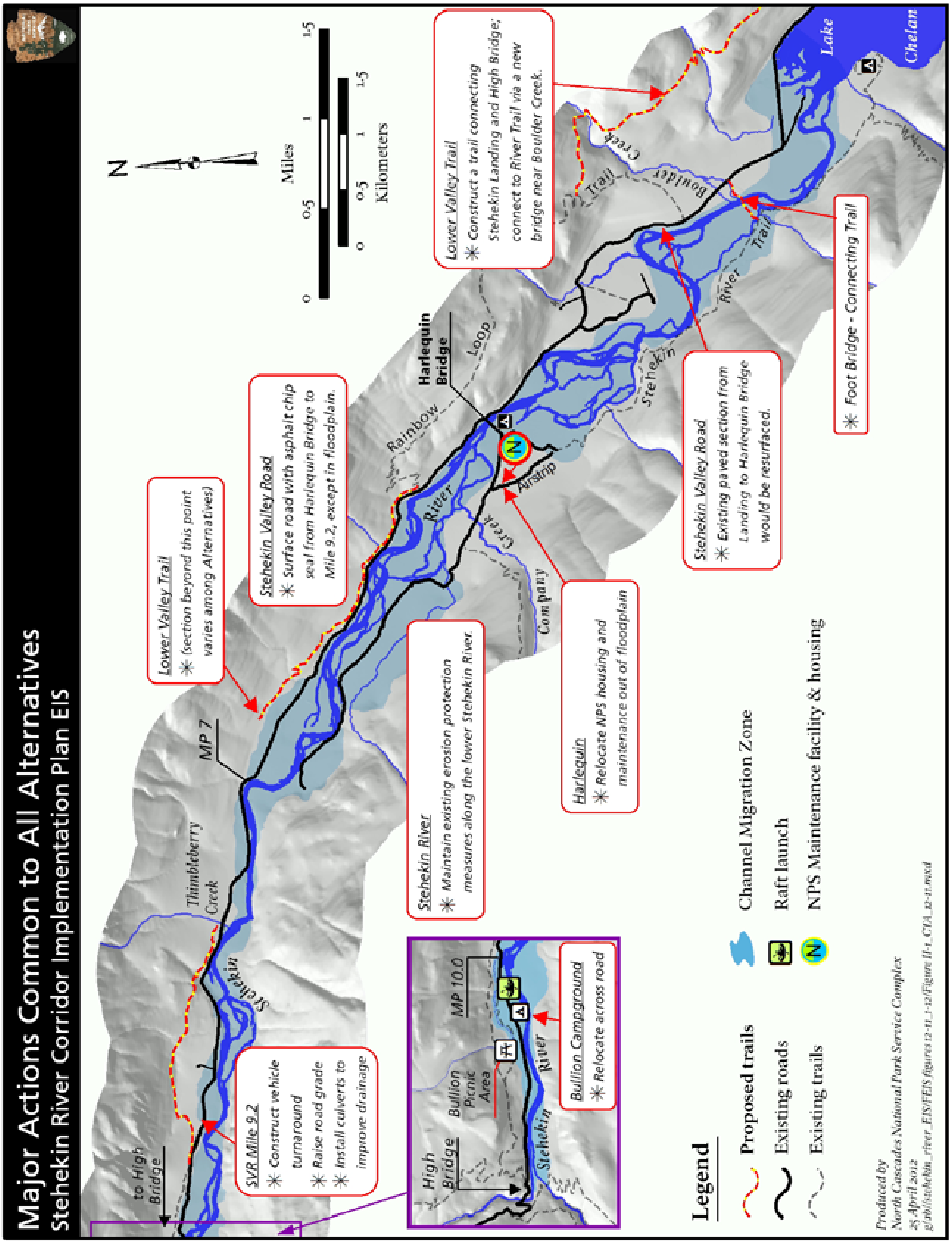
Actions called for by the 1995 Lake Chelan NRA GMP that would be implemented by all alternatives include replacement and relocation/construction of the NPS maintenance compound to the north end of the airstrip; replacement and relocation/construction of administrative housing; creation of a Lower Valley Trail that connects Stehekin Landing (Landing) to High Bridge and which is also connected to the Stehekin River Trail via a footbridge; and the ongoing use of willing seller-willing buyer land exchange and acquisition to encourage the removal of unsustainable development from the Stehekin River floodplain. Actions involving administrative and maintenance facilities require additional site-specific environmental impact analysis and are not analyzed in detail in this document.

Floating large woody debris could continue to be removed from the head of Lake Chelan and used for NPS management projects. Individual pieces could also be turned or trimmed (subject to NPS approval) to maintain safe rafting in the Stehekin River, while logjams could only be removed to protect Harlequin Bridge and public roads.

The Company Creek Road would be maintained in its existing alignment, and existing erosion protection measures along the Stehekin Valley and Company Creek roads would be maintained, including the 400-foot-long levee constructed in 1981. The levee has virtually no effect on floodplain utilization because of its short length and location and is necessary to maintain the Company Creek Road in place as called for by the GMP.

Photo 3 – Stehekin Valley Road in McGregor Meadows during the 2006 flood.

**Figure i-4: Major Actions Common to All Alternatives**



The Stehekin Valley Road at Wilson Creek, Milepost 8.0, and Frog Island would be protected in place in all alternatives because these locations have severe erosion problems and no viable reroutes. Actions to protect these areas, however, would vary among the alternatives. Grade-control structures designed to maintain sheet flow in floodplains during large floods at Milepost 7.0 and 9.2 on the Stehekin Valley Road and along the upper Company Creek Road would also be maintained. These structures were installed by public-private partnerships in 1998 and 2008 and are consistent with the concept of floodplain utilization because they protect the road from being occupied by the river. Consistent with the current GMP, logjams could be manipulated on the Stehekin River to protect Harlequin Bridge and public roads.

**Recreational Facilities**: Bullion Camp would be relocated downstream and across the road to mitigate safety concerns associated with hazard trees in the current camp. Day use, however, would be retained at the former Bullion Camp.

## 3. Alternative 1 (No Action): Continue Current Management Practices and Existing Plan Implementation

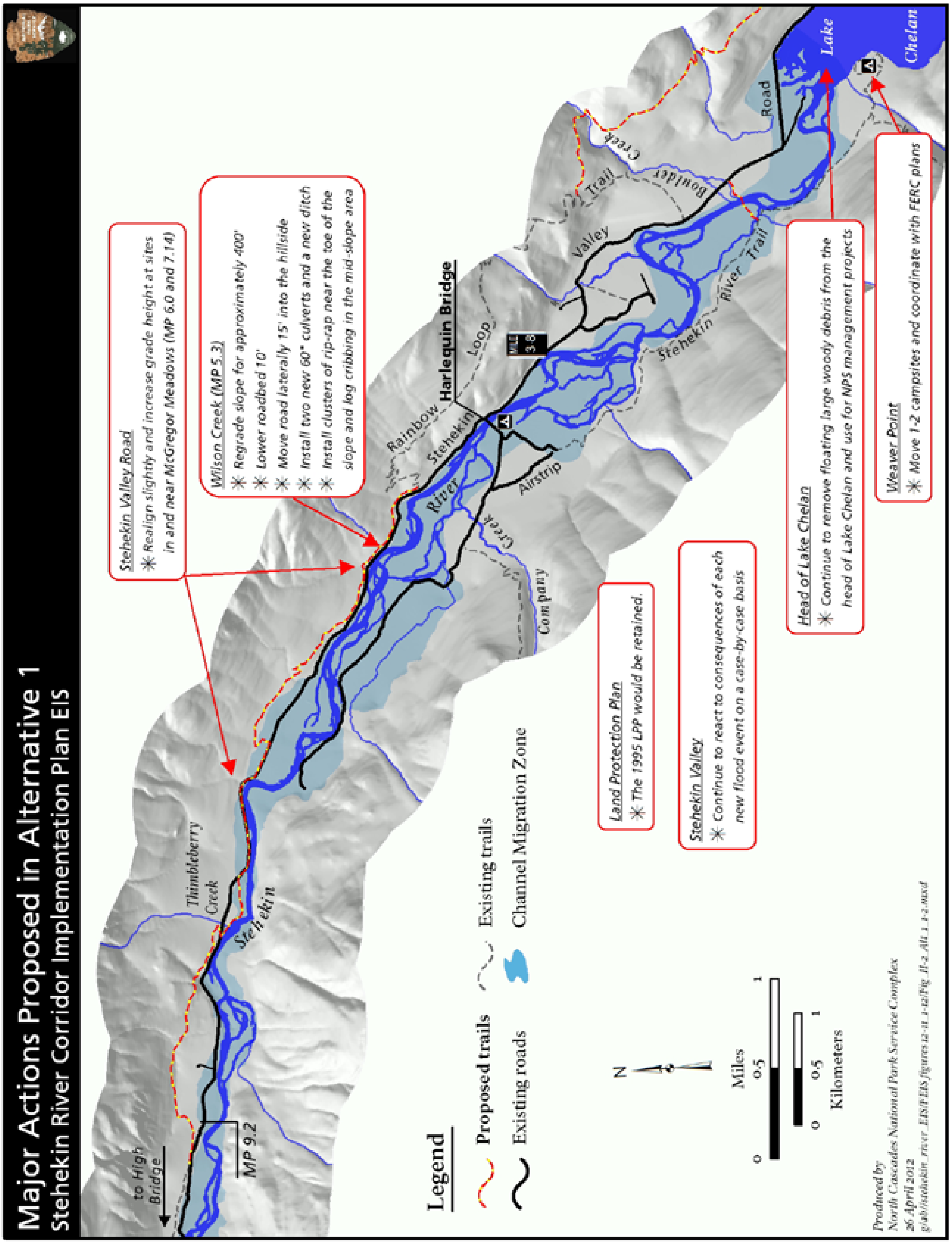
This alternative would continue existing management practices and improvements called for by existing plans evaluated and selected in the 2005 Stehekin Valley Road Improvement Project EA and associated Finding of No Significant Impact (Figure i-5: *Major Actions Proposed in Alternative 1*). It also includes continuing implementation of the 1995 GMP, as described previously under "Actions Common to All Alternatives (1 - 5)" and the 1995 LPP.

Implementation of the 1995 LPP would continue, using existing criteria and potential exchange lands. Decisions regarding land exchange / acquisition priorities would continue to be based on properties identified with currently out-of-date floodplain boundaries and the goal of protecting scenic resources (areas of high visual sensitivity) along the Stehekin Valley Road. Both the Stehekin Valley Road and the Company Creek Road would be retained in their existing alignments.

Stehekin Valley Road Improvement Project actions would be implemented and would include rehabilitation and surfacing of the road with an asphalt chipseal for 4.9 miles from Harlequin Bridge to the winter turnaround (Milepost 9.2), except for areas within the floodplain. There would be a slight realignment (between Mileposts 6.0 and 6.5) and two grade increases (from Milepost 6.25 to 6.53 and from Milepost 6.95 to 7.14) using approximately 5,600 cubic yards of fill through McGregor Meadows, as well as implementation of erosion protection measures at Wilson Creek (riprap clusters) (NPS LACH 2005). To retain the roads, Alternative 1 would also include maintenance of, but not major improvements to, existing erosion protection measures along the lower Stehekin River. Routine maintenance actions, including snow removal; spring opening; unpaved road grading, shaping, and repair; paved road asphalt patching; ditch clearing; culvert cleaning; vegetation maintenance; traffic control striping; and sign replacement, would also continue as needed. It is anticipated that existing pavement would be resurfaced (from the Landing to Milepost 9.2) during or shortly after road projects above Harlequin Bridge.

In Alternative 1, unlike other alternatives, the NPS would continue to react to the consequences of each new flood event on a case-by-case basis, producing individual environmental assessments (EAs) as needed to implement management actions.

**Figure i-5: Major Actions Proposed in Alternative 1**



Parts of the Stehekin Valley Road and Company Creek Road would continue to lie adjacent to and within the floodplain / channel migration zone of the Stehekin River. Over time, it is anticipated that this would continue to require the NPS to install additional erosion protection measures in the river (e.g., rock barbs) to protect roads and public facilities. There would continue to be limited improvements to visitor and administrative facilities within the lower Stehekin Valley to implement the GMP. In Alternative 1, rehabilitation of the Stehekin Valley Road would be implemented upon approval of this FEIS. Replacement and relocation of the maintenance facility and NPS housing (NPS Tracts 06-118, 06-104, 06-121, and 06-122) would be implemented following site specific environmental analysis and approval of a tiered environmental assessment.

In Alternative 1 as in other alternatives, private landowners could continue to implement the U.S. Army Corps of Engineers "Advanced Flood Protection Measures" (Appendix 7), including elevating cabins or constructing measures to protect private structures from the largest floods.

Recreational opportunities associated with the Stehekin River would continue, including camping, rafting, and hiking. As noted above, the Lower Valley Trail would be constructed to link the Landing with High Bridge, including connecting it to the Stehekin River Trail with a bridge near the mouth of Boulder Creek. In this alternative the trail would use 6.1 miles of existing trail and would require 6.3 miles of new trail to be constructed.

## 4. Elements Common to All Action Alternatives (2 - 5)

In addition to the actions that would be common to Alternatives 1 - 5, there are a variety of elements common to Alternatives 2 - 5, including proactive measures to protect administrative and public facilities from the future consequences of flooding.

Photo 4 – Floor of NPS Maintenance Shop after 2003 flood.

## Erosion Protection Measures

A logjam and new grade-control structure would be installed near Milepost 2.0 (Boulder Creek) to maintain sheet flow in the floodplain. Erosion protection measures would also be undertaken near the river mouth, Milepost 3.8 (Frog Island), Weaver Point, and Milepost 5.3 (Wilson Creek), though specific actions would vary by alternative.

The raveling slope at Milepost 8.0 would also be stabilized by laying back the uppermost part of the slope brow, which produces most of the large rocks that fall onto the road, and scaling (removing) rocks below this. A rockery wall (100 - 150 feet long and three to eight feet high) would also be added at the base of a portion of the slope.

Large woody debris could be manipulated within the Lake Chelan backwater zone (0.25 mile from the head of the lake up the Stehekin River) if it posed a threat to the Stehekin Valley Road or water quality. Under certain conditions, it could also be used for agency-permitted erosion protection measures on private lands after collection by the NPS.

In addition, because there is a large volume of wood now in the river system and because of the backwater influences of Lake Chelan, there is the potential for a large logjam to cause flooding of the densely developed area near the Bakery or to preclude access on the Stehekin Valley Road. Under these emergency conditions, large logjams in this area could be manipulated to remove the threat, consistent with the GMP. The wood taken from this area could only be used in the channel migration zone for erosion protection and/or restoration projects.

## Restoration

Restoration of a 300-foot-long riparian strip along the Stehekin River at Buckner Homestead lower hayfield and pasture and along the Lower Field would occur, as would bioengineering (layered planting of native shrubs) associated with erosion protection measures.

## Private Property Access

If access to private property was compromised by river encroachment, the NPS would work with private landowners on a case-by-case basis to evaluate alternative access. This would be modified in Alternative 5 with the construction of the Reroute Access Connector, which would link private property in McGregor Meadows to the rerouted Stehekin Valley Road.

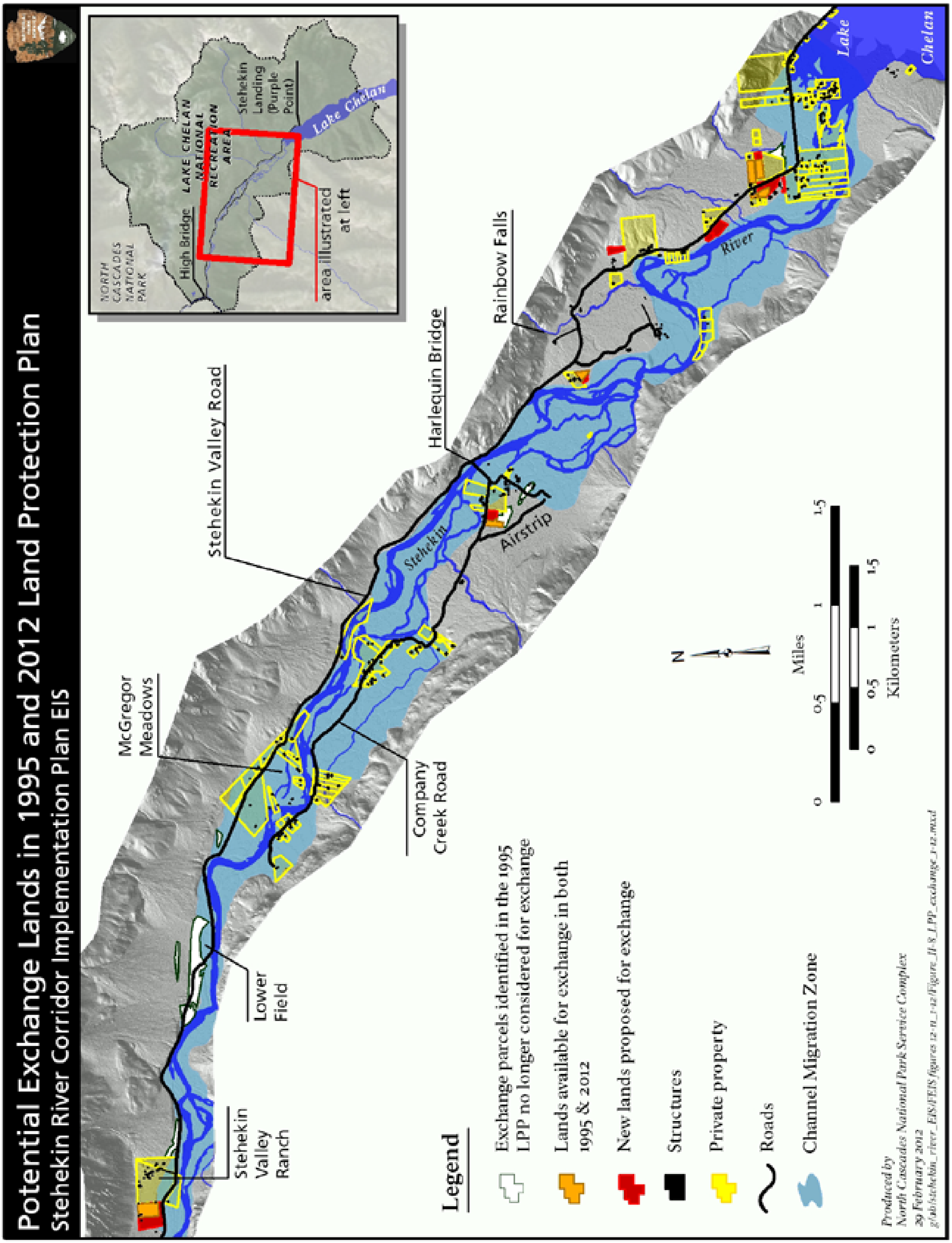
## Land Protection Plan

The NPS would make new exchange lands available through the revised Land Protection Plan (Figure i-6: *Potential Exchange Lands in the 1995 and 2012 Revised Land Protection Plan*).

## Recreational Facilities

New individual camping would occur near Rainbow Falls and group camping would occur at Purple Point Horse Camp.

**Figure i-6: Potential Exchange Lands in the 1995 and 2012 Revised Draft Land Protection Plan**



## 5. Alternative 2: At-Risk Public Facilities Removed from the Channel Migration Zone Where Possible; More Priority Land Exchange / Acquisition in the Channel Migration Zone (Environmentally Preferable)

Compared to other alternatives, Alternatives 2 and 5 would allow the Stehekin River the most space to utilize its floodplain and move within its natural channel migration zone over time (Figure i-7: *Major Actions Proposed in Alternatives 2 and 5*). Bank stabilization on the left bank is proposed at three new sites to protect the road, including at the Stehekin River mouth, Milepost 3.8 (Frog Island), and Milepost 5.3 (Wilson Creek). At Mileposts 3.8 and 5.3 the river is at the edge of the channel migration zone, and relocation into steep cliffs is not feasible. Therefore rock barbs have been identified for these locations. As in other alternatives, Alternative 2 would also implement GMP provisions (including maintenance facility and housing relocation and construction of the Lower Valley Trail); however, there would be a change in the use of large woody debris to implement erosion protection / habitat restoration measures. Alternative 2 would include limited use of wood from logjams in the river mouth area up to Boulder Creek, where the Stehekin River is influenced by backwater from Lake Chelan during flooding. Such use would only be from the tops of prescreened jams, and only if the jam would not be destabilized. The NPS would collect and stockpile wood from logjams after obtaining permits from federal and state agencies.

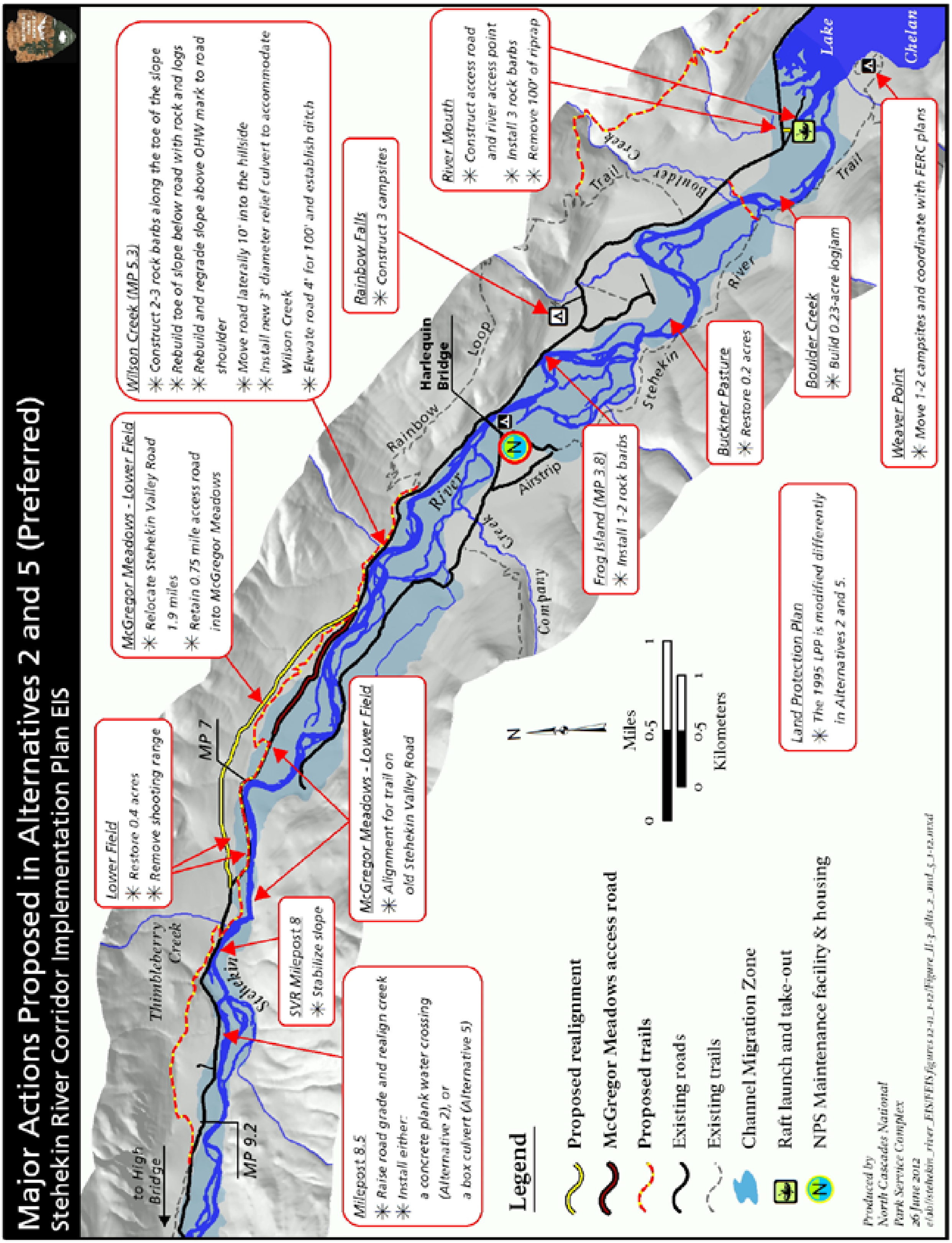
The revised LPP would be used to encourage relocation of private property from within the floodplain / channel migration zone to outside the channel migration zone, using management actions such as land exchange or land acquisition from willing sellers. Land protection priorities would identify specific properties that are most threatened by the Stehekin River as it migrates across its channel migration zone. If development at these sites was claimed by the river, debris from cabins, wells, and septic systems, including effluent, would be incorporated into the river. The criteria in the LPP used to identify NPS lands for potential exchange has been weighted more toward removing private development from the floodplain in Alternatives 2, 3 and 5 than in Alternative 4 (see Appendix 11 for the priority ranking of private lands in Alternatives 2 and 3 and Appendix 13 for the ranking in Alternative 5). In all action alternatives, new exchange parcels outside the channel migration zone would be made available, while some lands available for exchange in the 1995 GMP would no longer be available due to new or changed conditions.

The Stehekin Valley Road would be rerouted from Milepost 5.7 to 7.5 (Figure i-8: *McGregor Meadows Reroute Map*). Because the reroute has been professionally designed to meet or exceed modern road standards, the alignment meets key principles for safety, design and maintenance.

An access road would be maintained into McGregor Meadows from Milepost 5.7 to 6.5, to the last parcel of private property (07-157), until it is no longer needed. From a turnaround at the end of the access road, administrative access would continue to be provided to the grade-control structures at Milepost 7.0. From Milepost 6.8 to 7.5, the road would be rehabilitated as part of the Lower Valley Trail. The portions of the Stehekin Valley Road before and after the reroute would also be rehabilitated and surfaced with an asphalt chipseal.

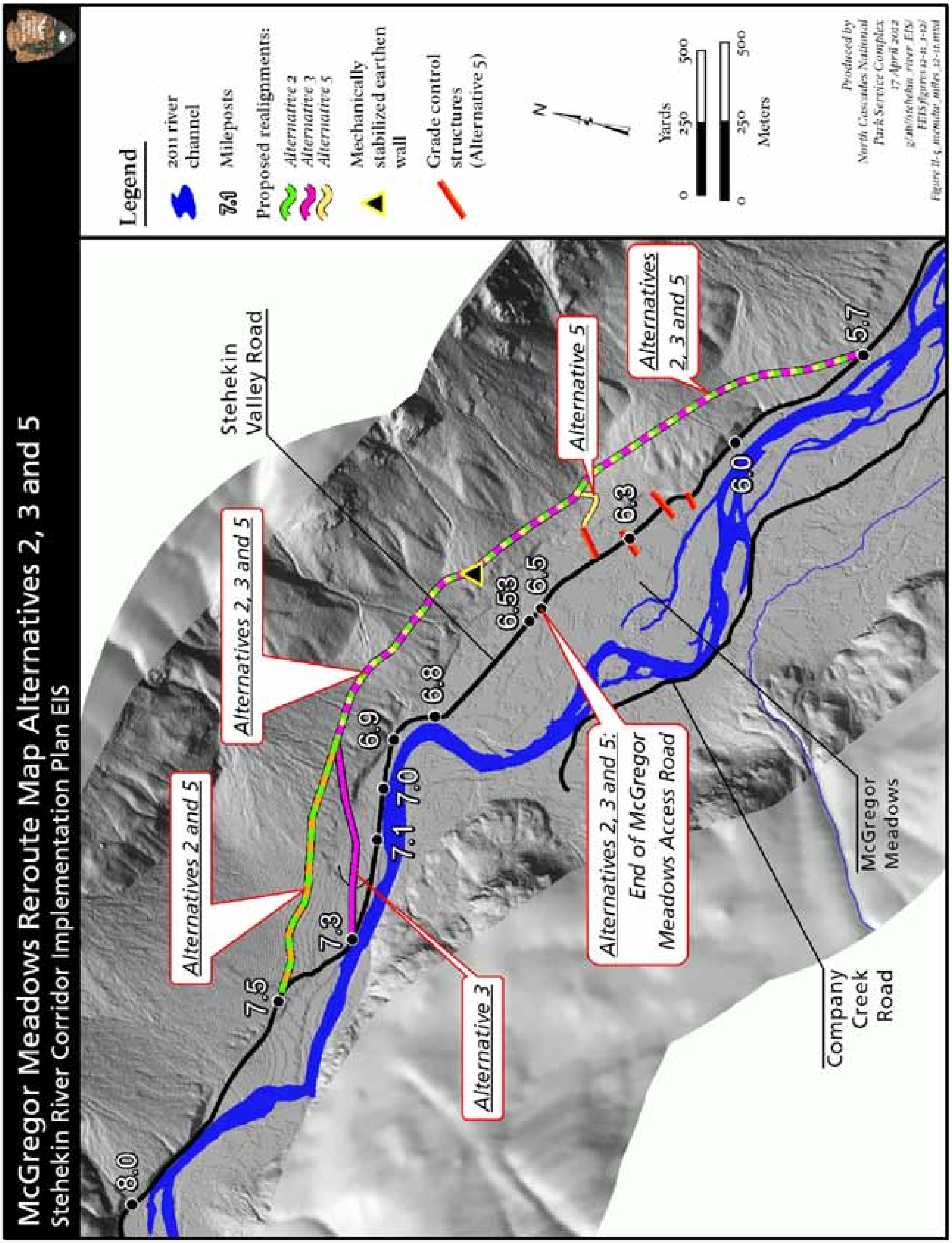
Under Alternative 2, there would also be a series of erosion protection measures to stabilize those sections of the Stehekin Valley Road that are at the edge of the channel migration zone and cannot be relocated without major slope removal or extensive new road construction.

## Figure i-7: Major Actions Proposed in Alternatives 2 (Environmentally Preferable) and 5 (NPS Preferred)




*See Appendix 17 for a separate map of Major Actions Proposed in Alternative 5.*

## Figure i-8: McGregor Meadows Reroute Map



Rock barbs would be constructed at Wilson Creek (two to three barbs) and Frog Island (one to two barbs). Three more barbs and a small logjam would be located at a key point on the left bank (looking downstream) above the river mouth. One or two of the barbs would replace 100 feet of rip-rap, and the bank would be revegetated with native shrubs. At Weaver Point, bank stabilization would be coordinated with plans under development by Chelan PUD for recreation, erosion, and cultural resource management. Riparian restoration and/or bioengineering (layered planting using native shrubs) would enhance riparian vegetation along the bank, at the Lower Field, Buckner Homestead hayfield and pasture, Wilson Creek, Frog Island, and the river mouth.

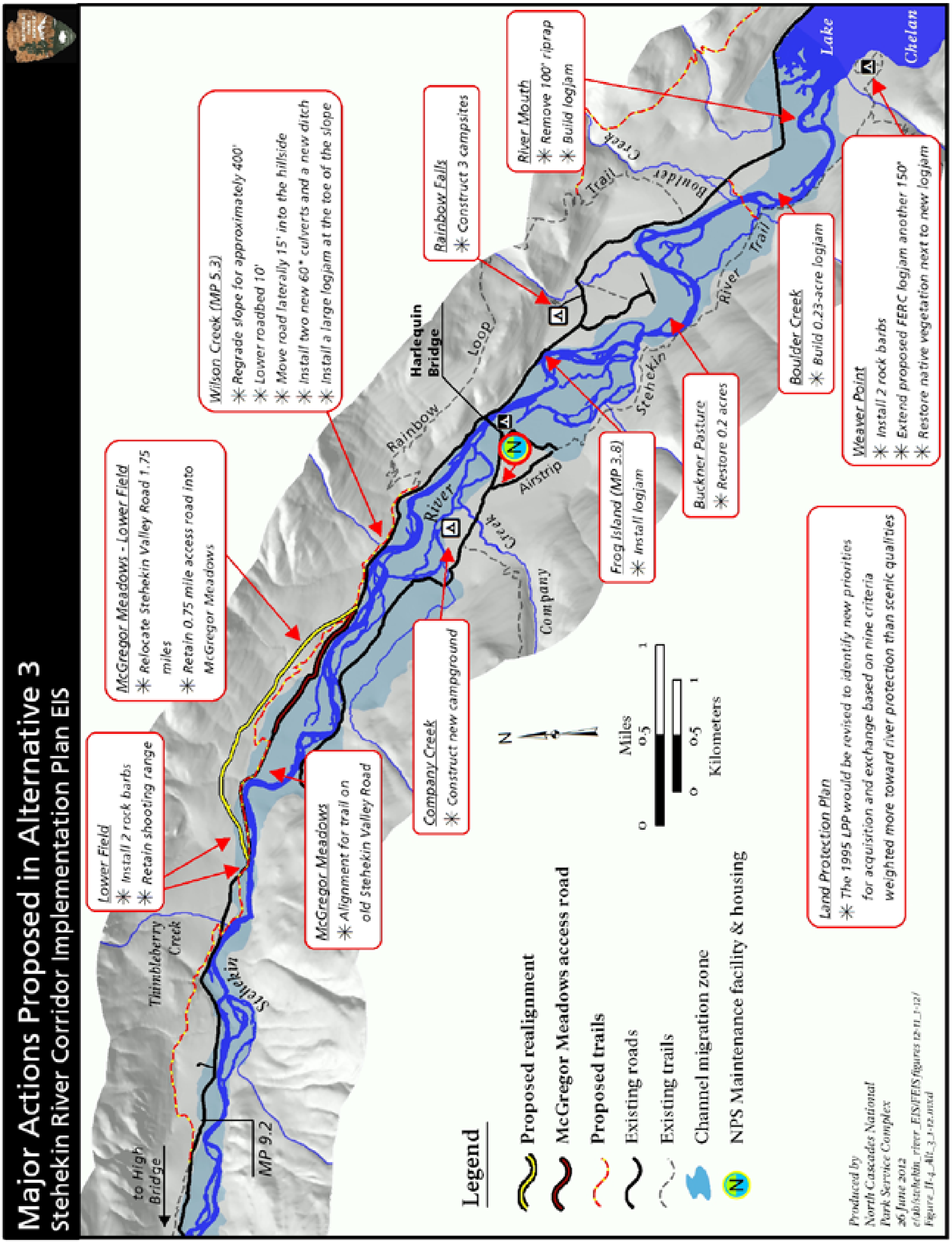
Compared to Alternative 1, Alternatives 2 - 5 would propose some manipulation of woody debris within the Lake Chelan backwater zone (which extends 0.25 mile from the head of the lake at full pool, up the Stehekin River). In this area of the lower Stehekin River and at Harlequin Bridge, large logjams that threatened public roads, water quality, public safety, and regular access to private property could be altered to relieve threats. Woody debris from the tops of some logjams and from floating logs in Lake Chelan could also be made available to landowners (for agency-permitted erosion protection) after it was collected and sorted by the NPS. The wood could only be used in the channel migration zone for erosion protecton and/or restoration projects, and/or Advanced Flood Protection Measures. This action would limit importation of large rock and acknowledges the large amount of wood currently on the river.

Recreational opportunities, including camping, rafting, and hiking associated with the Stehekin River would be enhanced. As in Alternative 1, the Lower Valley Trail would be constructed to link the Landing with High Bridge, including connecting it to the Stehekin River Trail. In this alternative (as in Alternatives 3 and 5), fewer miles of new trail (4.6 miles) would be needed since the trail would use some former roadway (1.7 miles) and existing trail (6.2 miles). New group camping opportunities would be located at Purple Point Horse Camp to replace the group campsite at Harlequin when it is seasonally flooded. Approximately three new individual sites would also be located near Rainbow Falls. In addition, a new river access point would be provided near the Stehekin River mouth, which would require a small new parking area and a 300-foot-long access road off of the Stehekin Valley Road. Because the shooting range is located along the proposed Lower Field reroute, it would be closed and restored. No replacement shooting range would be constructed.

## 6. Alternative 3: At-Risk Public Facilities Removed from Channel Migration Zone in Most Areas; Same Land Protection Plan as Alternative 2

Alternative 3 would allow the Stehekin River slightly less room to move within its natural channel migration zone and requires the use of different erosion protection measures than in Alternatives 2 and 5 (with four barbs and five logjams, instead of six to eight barbs and two logjams as in Alternatives 2 and 5) (Figure i-9: *Major Actions Proposed in Alternative 3*). As in other alternatives, Alternative 3 would implement the GMP replacement and relocation of the maintenance facility / housing and construction of the Lower Valley Trail. Different erosion protection approaches were developed since the rock barbs and logjams have different benefits and installation impacts. The number of erosion protection measures increases from Alternative 2/5 through Alternatives 3 and 4, consistent with the overall degree to which each alternative constrains the river. As in Alternative 2, there would be a minor change regarding the use of woody debris, and the revised 2010 LPP would be used.

**Figure i-9: Major Actions Proposed in Alternative 3**



The reroute of the Stehekin Valley Road in Alternative 3 would be slightly shorter than the one proposed in Alternative 2. The reroute would begin at Milepost 5.7 and would end at Milepost 7.3 (Figure i-8: *McGregor Meadows Reroute Map*). With the shortening of the reroute (compared to Alternatives 2 and 5), the portion of the existing road that borders Lower Field would be stabilized with riparian vegetation and rock barbs. As in Alternative 2, an access road from Milepost 5.7 to Milepost 6.5 would be retained up to the last private parcel in McGregor Meadows until it is no longer needed; and administrative access would also be maintained to Milepost 6.8 for maintenance of grade-control structures. From Milepost 6.8 to Milepost 7.3, the road would be rehabilitated as part of the Lower Valley Trail.

Four rock barbs would be constructed along the bank at Weaver Point (two barbs) and Lower Field (two barbs), while large logjams would be constructed at Weaver Point, near the Stehekin River mouth, at Boulder Creek (and an avulsion sill), at Frog Island, and at Wilson Creek. Restoration and/or bioengineering would also occur in the same locations as in Alternative 2.

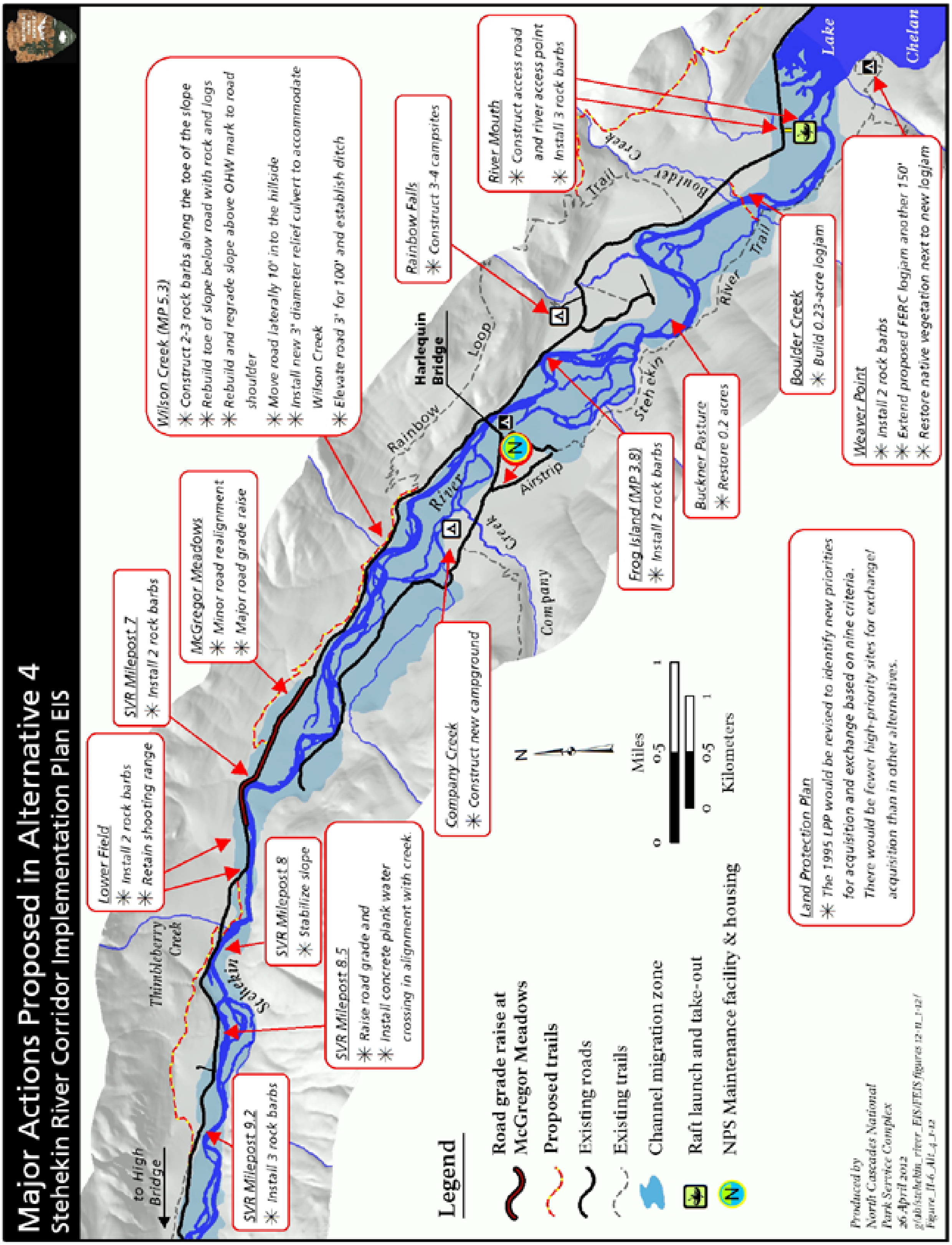
Management of woody debris would be the same as in Alternatives 2 and 5. Recreational improvements would be similar to Alternatives 2 and 5; however, additional camping opportunities would also be provided at Company Creek at a previously disturbed site outside the Stehekin River channel migration zone, and no new river access point would be constructed near the Stehekin River mouth.

## 7. Alternative 4: At-Risk Public Facilities Removed from Channel Migration Zone in Some Areas; Less Priority Land Exchange / Acquisition in Channel Migration Zone

Compared to Alternative 1, Alternative 4 would allow for some additional movement of the Stehekin River within its channel migration zone, if private property was purchased or exchanged. Unlike Alternatives 2 and 3, if Alternative 4 was selected, the revised 2010 LPP (Appendix 13) would be revised to rank priority lands per the criteria shown in Table II-5. As in Alternative 1 without a reroute, Alternative 4 would constrain the movement of the Stehekin River from a large part of its floodplain through McGregor Meadows and at Lower Field because it would raise the grade of the road through McGregor Meadows (Figure i-10: *Major Actions Proposed in Alternative 4*). The LPP revision would be different than in Alternatives 2 and 3. Appendix 11 lists the priority ranking of private lands for Alternatives 2 and 3; Appendix 12 lists the priority ranking of private lands for Alternative 4. Exchanges would be focused less on properties along the river, and more on sustaining the current development pattern. Because of this, there would be fewer parcels with a high priority for acquisition that would allow for their removal from the channel migration zone. Some private development in flood-prone areas near the river channel, however, would be considered for exchange or purchase. Actions associated with GMP implementation (including replacement and relocation of the maintenance facility and NPS housing and construction of the Lower Valley Trail) would be the same as in "Actions Common to All Alternatives (1 - 5)."

As in Alternatives 2, 3 and 5, there would be stabilization and riparian restoration of the bank along the Lower Field. As in Alternative 1, instead of a reroute around McGregor Meadows, the Stehekin Valley Road would be raised in some locations to minimize flood damage, and 4.9 miles of the road would be rehabilitated and surfaced between Harlequin Bridge and the winter turnaround in addition to the area that would be resurfaced from the Landing to Milepost 9.2.

**Figure i-10: Major Actions Proposed in Alternative 4**



There would be additional placement of barbs and bioengineering for erosion protection measures implemented along the Stehekin River, not only at the Lower Field (as in Alternative 3), but also near Milepost 7.0 and Milepost 9.2. To maintain the Stehekin Valley Road in its existing alignment, Alternative 4 would have the greatest number of locations (7) where erosion protection measures would be undertaken. Rock barbs would be constructed at Weaver Point (two barbs), Stehekin River mouth (three barbs), Frog Island (two barbs), Wilson Creek (two to three barbs), Lower Field (two barbs), Milepost 7.0 (two barbs), and Milepost 9.2 (three barbs), and a large logjam/avulsion sill would be constructed at Boulder Creek along the bank extending into the forest. Riparian restoration and/or bioengineering (layered planting associated with rock barbs or logjams) would also occur in the same locations as in Alternatives 2 and 3.

Use of woody debris would be the same as in Alternatives 2, 3 and 5, with both NPS and private, permitted use, except that woody debris could be used from the tops of prescreened logjams from areas below the Bullion raft launch, including at McGregor Meadows. (This is in contrast to Alternatives 2, 3 and 5, which restrict taking logs from the river to below Boulder Creek in the Lake Chelan backwater zone.)

Recreational improvements would be the same as in Alternative 3 except there would be a new river access point in this alternative, as in Alternatives 2 and 5. Construction of the Lower Valley Trail would be similar to that proposed in Alternative 1, with 6.1 miles of existing trail and 6.3 miles of new trail.

## 8. Alternative 5: At-Risk Public Facilities Removed from Channel Migration Zone Where Possible; Priority Land Exchange / Acquisition in Most Vulnerable Areas (NPS Preferred)

Actions would be similar to Alternative 2, except for the following differences:

- On the proposed reroute of the Stehekin Valley Road a mechanically stabilized earth (MSE) wall would be constructed to avoid a slightly longer reroute with more slope impacts;
- A 940-1,200-feet-long Reroute Access Connector (linking the McGregor Meadows Access Road and the realigned Stehekin Valley Road) would be constructed;
- Instead of implementing the revised 2010 LPP, the LPP would be revised to use a different set of scoring criteria for the priority ranking system;
- In addition to the erosion protection measures identified in Alternative 2, a) four grade control structures could be constructed (beneath three driveways and from the Stehekin Valley Road to the access spur); b) the fill-side shoulder would be stabilized at Skinny Wilson's (Milepost 5.1); and c) there would be a box culvert instead of a concrete plank ford at Milepost 8.5;
- NPS housing could be constructed at other appropriate locations in the lower valley; and
- The location and use of part of the Lower Valley Trail would be modified.

The MSE wall (Figure i-7) would be located above NPS Tract #07-157 on the reroute, above an existing private borrow area. The height of the wall would vary from 2-3 feet at the ends to approximately 16 feet near the middle; however the exposed (visible) height would be approximately three feet less because the bottom part of the wall would be buried. The wall would be approximately 230 feet long and native shrubs and trees would be planted in the soil below the bottom of the wall to help hide the wall face from view. The components of the wall would also be permanently treated to blend with the colors of the surrounding stone and soil. Its construction would reduce the loss of additional large trees along the reroute and would minimize the amount of slope disturbance (cuts and fills) in this steep area.

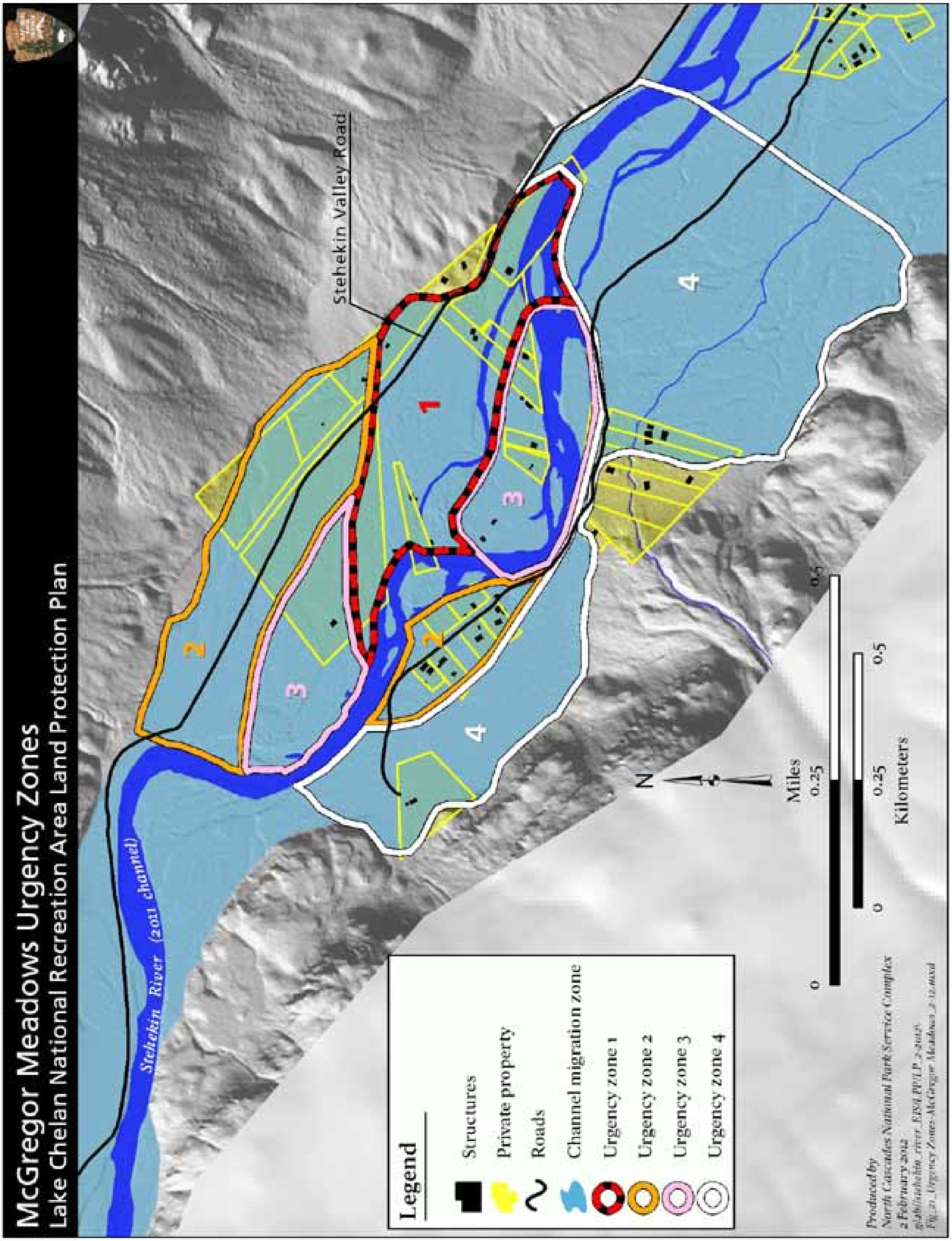
The MSE wall would be constructed by excavating the wall foundation elevation and then building the wall in layers. Each layer would include wire facing, a geotechnical fabric layer to retain backfill, and a reinforcing layer to connect the facing to the backfill behind the wire. Soil would be overlain on the top of the wall and a guardrail installed along the road shoulder to increase safety.

The Reroute Access Connector would provide access to the McGregor Meadows area if the existing alignment washes out and repairs are too expensive and/or the NPS cannot obtain needed permits to repair it (i.e. river runs down road through summer). The connector would be approximately 12-feet wide and 0.22 miles (940 - 1,200 feet) long. From the road reroute, it would be constructed across public and private property (NPS Tract 07-201) under a public-private partnership to join the reroute with the McGregor Meadows Access Road.

As in Alternative 2, the LPP would be used to encourage relocation of private property from within the floodplain / channel migration zone to outside of it, using management actions such as land exchange or land acquisition from willing sellers. Land protection priorities would identify specific properties most threatened by the Stehekin River within McGregor Meadows and other vulnerable areas (deposition zones and active parts of debris cones). As in Alternatives 2 and 3, these criteria would be weighted more toward removing private development from threats by the river than in Alternative 4; however unlike in Alternative 2, the focus of the criteria would also include protection of scenic resources. As in Alternatives 2 - 4, new exchange parcels outside the channel migration zone, or other hazard zones, would be made available, while some lands available for exchange in the 1995 GMP would not be available. One additional parcel (a corral that is part of Tract 05-122) not in the revised 2010 LPP, however, would also be available for exchange, but only for agricultural use. A larger parcel of land (part of Tract 08-104) above the Stehekin Valley Ranch is also proposed for exchange. In Alternative 5, this area would be 10.2 acres, rather than 5.2 acres (as in Alternatives 2 - 4).

The revision to the LPP in Alternative 5 would include eight criteria, including two new ones (visual sensitivity and presence in a debris cone hazard zone). In Alternative 5, the primary driving factors include flooding and streambank erosion impacts on development. Flooding and erosion are most pronounced in areas where the river deposits gravel and large wood. These areas are located at distinct points where the valley widens (McGregor Meadows), between the large tributary alluvial fans of Company, Boulder, and Rainbow Creeks, and at the Stehekin River mouth (Figure i-11: *McGregor Meadows Urgency Zones*). Hazardous areas are also located on debris cones where rapid deposition can occur at any time of year. Similar hazard concerns exist for alluvial fans within Lake Chelan NRA, but that threat is considered less severe and the criteria used to evaluate those concerns are weighted less. Other criteria include the presence of wetlands, rare species habitat, and cultural resources, as well as a criterion that emphasizes larger, undeveloped blocks of land within the valley.

**Figure i-11: McGregor Meadows Urgency Zones**



Beneath three driveways into McGregor Meadows and from the McGregor Meadows Access Road to the access spur, four new grade control structures could be designed to maintain sheet flow, slow avulsion, and to limit the amount of gravel introduced to the Stehekin River from McGregor Meadows. The grade control structures would extend beyond the length of the driveway or roadway area and would be a combined 1,000 feet long, six feet wide and three feet deep, and would be constructed of approximately 600 cubic yards of rock. They would also extend across the Stehekin Valley Road. The grade control structures would need to be constructed through a public-private partnership, with the NPS providing technical assistance and property owners responsible for the construction on their property.

At Milepost 5.1 (across from the Skinny Wilson homestead), 40 feet of road shoulder would be stabilized by constructing a rock wall to replace the decomposing logs that currently support the road shoulder. A large (20-inch) big-leaf maple at one end of the section would be retained.

At Milepost 8.5, instead of a low water crossing as in Alternatives 2 - 4, a box culvert would be used to improve access for bicyclists and the road grade would be raised three to four feet over a distance of approximately 450 feet. The culvert would be approximately 3-4 feet x 6 feet x 30 feet and would have pre-cast concrete wing walls to minimize its length. A removable concrete lid is proposed. To facilitate water reaching the Stehekin River, an outlet relief channel 6-feet wide, 3-feet deep and 100-feet long (following the natural channel) would be created. Rip-rap check dams would be used to slow the flow as it enters the Stehekin River. Tree wells may be required to protect some large cottonwoods near the intersection with the private road. Some, however, may need to be removed. Other smaller trees would need to be removed to create the outlet channel.

Similar to Alternative 2, the NPS maintenance area and some housing would be constructed on land identified in the GMP for that purpose near the airstrip. Unlike Alternative 2, NPS housing could also be constructed in other appropriate locations in the lower valley. As with development of the new maintenance area, additional environmental analysis would be needed.

The Lower Valley Trail alignment would be modified in the vicinity of the Stehekin Valley Ranch to minimize impacts to private property. It could also include another section of multi-use trail from the Stehekin Valley Road to Buckner Orchard using the alignment of the historic entrance (as recommended in the Buckner Homestead Historic District Management Plan). The proposed Lower Valley Trail would be constructed as described in the DEIS except that the trail would not go behind the ranch and would instead connect to the Stehekin Valley Road by linking with the trail at Bullion at Milepost 9.2. Bicycle use would also be allowed on the decommissioned portion of Stehekin Valley Road (McGregor Meadows Access Road and area above Milepost 6.5 to the Lower Field) but there would be no manipulation of the Stehekin River to protect this trail alignment for bicycles. In the future, additional bicycle access would likely be available by implementing the Buckner Homestead Historic District Management Plan recommendation to construct a multi-use trail from the Stehekin Valley Road to Buckner Orchard along the historic entrance road, instead of Buckner Lane (which would be closed to bicycle use). It is envisioned that the Lower Valley Trail could be constructed in segments over an extended period of time (e.g. ten years).

## 9. Consistency of Alternatives with Purpose and Need

As explained at the beginning of this section, the primary purposes of this draft Stehekin River Corridor Implementation Plan / environmental impact statement (SRCIP/EIS) are to:

1. Sustainably operate and maintain NPS administrative facilities, public access (via roads and trails), and campgrounds;
2. Protect water quality, scenic values, habitat, and natural processes of the Stehekin River; and
3. Partner with the Stehekin Community to provide services, facilities and experiences for visitors.

These purposes are consistent with the Lake Chelan NRA GMP (NPS LACH 1995).

All action alternatives (2 - 5) would improve the sustainability of the Stehekin Valley Road and would relocate administrative facilities currently in the floodplain / channel migration zone. Alternatives 2 and 5, however, would best meet this purpose because they would move most of the Stehekin Valley Road out of the floodplain / channel migration zone, therefore resulting in more sustainable NPS administrative facilities and public access.

Because Alternatives 2 and 5 would relocate a greater portion of the Stehekin Valley Road out of the floodplain / channel migration zone and would locate fewer erosion protection measures within the Stehekin River, they would best protect water quality and the natural processes of the Stehekin River. Alternatives 1 and 4 would protect the greatest degree of forested habitat, while Alternatives 2 and 5 would enhance the greatest degree of riparian habitat. Compared to Alternative 1, Alternatives 2 - 5 would reduce the amount of land that could be exchanged and would focus remaining land protection on the sites most at risk.

Maintaining the Stehekin Valley Road for vehicle access up to High Bridge would continue to enable people to access the entire length of Lake Chelan NRA and to reach North Cascades National Park. Loss or closure of the road at some mid-point could result in reduced access to recreational opportunities, including hiking, camping, picnicking, river rafting and wildlife viewing. Loss of access at some mid-point, depending on where it occurred, could also reduce vehicle access to private property along the road corridor. The Lake Chelan GMP calls for retaining vehicle access to High Bridge to meet these needs.

The revised LPP would meet the needs of the NPS to protect the values of Lake Chelan NRA and could also help the community by providing sustainable sites for future development outside the Stehekin River channel migration zone and by continuing to provide access on the lower Stehekin Valley Road.

# D. LIST OF ALTERNATIVES AND ACTIONS CONSIDERED BUT DISMISSED

Under the NEPA,(40 CFR 1502.14 (a)), CEQ's Frequently Asked Questions and NPS Director's Order 12, alternatives may be eliminated from detailed study based on the following reasons:

- Technical or economic infeasibility;
- Inability to meet project objectives or resolve need for the project;
- Duplication of other less environmentally damaging alternatives;

- Conflicts with an up-to-date valid plan, statement of purpose and significance, or other policy; and therefore, would require a major change in that plan or policy to implement; and
- Environmental impacts too great.

The following alternatives or variations were considered during the design phase of the project, but because they met one or more of the above criteria, they were rejected. Information about why these alternatives or actions were rejected is included in Chapter II (D: Alternatives and Actions Considered but Dismissed) of this document:

- Allow use of the airstrip for exchange to relocate private property outside of the floodplain.
- Implement additional flood protection (bank hardening) measures, such as rip-rap or levees along the banks of the Stehekin River to prevent flooding.
- Implement additional erosion protection measures at Buckner Homestead hayfield and pasture
- Exchange lands to allow private landowners to establish or maintain flood and/or erosion protection.
- Take action as part of the plan solely to protect private property.
- Reroute the Stehekin Valley Road at Milepost 8.0.
- Reestablish the southside Stehekin Valley Road along the Company Creek Road alignment, including constructing a new bridge.
- The scope of the plan should encompass the entire Stehekin River Watershed, including the area above High Bridge.
- Sediment and large woody debris sources above High Bridge and/or in the whole Stehekin watershed should be evaluated for treatment.
- The Stehekin River should be contained within a channel to reduce flooding of private property and public facilities.
- The plan should include actions that would resolve issues in the whole lower valley.
- The goal of the plan should be to allow natural processes to occur unimpeded so that natural flooding and erosion can continue to occur without regard to its effect on facilities and private property.
- Plan alternatives should include consideration of rerouting the Company Creek Road.
- Excess materials, including large woody debris and excavated gravel generated by the plan should be used for other public and private projects in Stehekin.
- Use suitable gravel for projects in the valley instead of importing materials at high cost.
- Pile burning or consumptive use of large woody debris generated by the plan should be considered.
- The plan should consider changes to the *Sand, Rock and Gravel Plan* to allow use of gravel generated by plan actions.

- Gravel removal should be used instead of land exchanges.
- Dredging should be part of the plan as long as it is done in a way that minimizes impacts.
- Reroute the Stehekin Valley Road at Milepost 9.2.
- Lower Field Land Exchange
- Lower the Stehekin Valley Road at Wilson Creek
- Remove trees near Wilson Creek to improve sight distance
- Reroute the Stehekin Valley Road around private property near the beginning of the reroute.
- Pave the Stehekin Valley Road shoulders
- Construct a culvert, rather than a low water crossing at Milepost 9.2
- Retain the Stehekin Valley Road in McGregor Meadows and add a road reroute later and other selected actions
- Construct one half of the reroute, depending on which part of the McGregor Meadows section of the Stehekin Valley Road would be most likely to blow out
- Construct the proposed Rainbow Falls Camp at the historic location of this camp
- Relocate the Shooting Range in Alternative 5.

Photo 5 – Harlequin Bridge.

# E. ENVIRONMENTALLY PREFERABLE ALTERNATIVE

Implementing regulations for NEPA promulgated by the CEQ require that agencies identify "the alternative or alternatives which were considered to be environmentally preferable." "Environmentally preferable" is defined as the alternative that will promote the national environmental policy as expressed in Section 101 of NEPA, including:

- Fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations;
- Ensuring for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- Attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- Preserving important historic, cultural and natural aspects of our national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice;
- Achieving a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
- Enhancing the quality of renewable resources and approaching the maximum attainable recycling of depletable resources. (NEPA Section 101(b))

The environmentally preferable alternative is "the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources (46 FR 18026 - 18038). According to Director's Order 12, through identification of the environmentally preferable alternative, the NPS and the public are faced with determining the relative merits of the choices before them as represented among the alternatives and must clearly state through the decision-making process what values and policies were used in reaching a decision. As shown through the analysis below, the environmentally preferable alternative is Alternative 2, as was described in the DEIS.

1. **Fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations:** All Alternatives (1 - 5) would fulfill this CEQ criterion because the NPS is required by law and policy to minimize its impacts on the environment and to preserve natural, cultural, and other park resources without impairment in its management of national parks, including Lake Chelan NRA. Of the alternatives, Alternatives 1 and 4 would have the fewest new impacts on Lake Chelan NRA resources, while Alternatives 2, 3 and 5 would have the fewest impacts on the floodplain / channel migration zone of the Stehekin River. Alternatives 2, 3 and 5 also represent more sustainable, long-term solutions to current issues. Alternatives 2 - 5 would improve existing adverse impacts to water resources by removing development from both the floodplain and channel migration zone of the Stehekin River. Because Alternatives 2, 3 and 5 would employ fewer erosion protection structures and would reroute the road away from the floodplain / channel migration zone of the Stehekin River instead of continuing to add structures to harden the banks of the river, Alternatives 2 and 3 and 5 would best meet the first CEQ criterion.

2. **Ensuring for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings:** Alternatives 2 - 5 would meet this CEQ criterion by minimizing impacts through implementation of mitigation measures, including impact avoidance and best management practices. Alternatives 2, 3 and 5 would improve safety for employees, residents, and visitors to Lake Chelan NRA by relocating part of the road out of the floodplain / channel migration zone. Alternative 3, however, would have a shorter reroute and would remain partially within the floodplain / channel migration zone. Alternative 5 would include construction of the Reroute Access Connector across a wetland and the channel migration zone. Therefore, Alternative 2 would best meet this criterion.

3. **Attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences:** Beneficial uses in all alternatives would include ongoing residential use, resource preservation, and recreational uses of the lower Stehekin Valley. Recreational uses would be broadest in Alternative 4, while protection of the Stehekin River floodplain / channel migration zone would be greatest in Alternatives 2 and 5. Alternatives 2 - 5 would also increase the diversity of recreational experiences through new campgrounds (Alternatives 2 - 5) and a new river access point (Alternatives 2 and 5). The fewest new short-term impacts to existing resources would occur in Alternative 1. Safety improvements associated with the Stehekin Valley Road would occur in all alternatives. As noted above, Alternatives 2, 3 and 5 would also have the greatest safety improvements from relocation of part of the Stehekin Valley Road out of floodplain. Overall, Alternatives 2 and 5 would best meet this criterion.

4. **Preserving important historic, cultural, and natural aspects of our national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice:** Although all alternatives would preserve historic and cultural resources, enhancement through interpretation would occur in Alternatives 2 - 5, which would best meet this criterion. None of the alternatives would affect portions of the Old Wagon Road or other resources eligible for the National Register.

5. **Achieving a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities:** The LPP revision implemented in Alternatives 2 - 4 would meet this CEQ criterion, because it would reduce the number of acres available for land exchanges and remove some sensitive lands still available in Alternative 1. The LPP revision in Alternative 5 would also have similar results. Among Alternatives 2 - 5, Alternatives 2, 3 and 5 would best meet this criterion because their intent is to remove development that is adversely affecting or could adversely affect the Stehekin River and its floodplain, but also its channel migration zone. They also would remove a portion of the Stehekin Valley Road from within the floodplain / channel migration zone to higher ground. Private developments now threatened by the changing flood regime on the Stehekin River would be identified as high priority for exchange or acquisition, thereby allowing affected property owners a means to avoid future flooding impacts if they so choose. Although Alternative 5 would also provide long-term access to the McGregor Meadows area, it would do so by affecting a wetland and a small part of the channel migration zone, therefore Alternative 2 would best meet this criterion.

6. **Enhancing the quality of renewable resources and approaching the maximum attainable recycling of depletable resources:** All Alternatives (1 - 5) would best meet this CEQ criterion because of the removal of the current maintenance facility and NPS housing from the floodplain and construction of new maintenance facility and housing on disturbed

lands near the Stehekin Airstrip. These facilities would meet standards for LEED certification. Of these alternatives, Alternatives 2, 3 and 5 would offer a slight advantage for this criterion because they would employ the least amount of imported resources, relying instead on the reuse of materials from within the proposed reroute areas.

Alternative 2 best meets each of the criteria. Although Alternatives 2, 3 and 5 each meet three or more of the criteria, only Alternative 2 meets all of them, therefore Alternative 2 is the environmentally preferable alternative.

# F. SUMMARY OF ISSUES AND IMPACT TOPICS CONSIDERED

Impacts of each alternative have been analyzed. The impact topics focus the discussion of impacts on the comparison of affected resources.

The following impact topics have been retained because measurable impacts would occur from implementation of the alternatives and because concerns about impacts related to these topics were expressed by the public and/or the interdisciplinary team. A detailed analysis of their inclusion is given in Chapter I*: Purpose of and Need for Management Action*.

- Land use;
- Air quality;
- Geologic hazards;
- Soils and vegetation;
- Water resources (including hydraulics and streamflow, water quality, wetlands, and floodplains);
- Wildlife;
- Special status wildlife;
- Prehistoric and historic archeological resources;
- Historic structures;
- Cultural landscapes;
- Visitor experience (including access and transportation, visitor use opportunities, interpretation and education, scenic resources, and safety);
- Wild and scenic rivers;
- Park operations;
- Socioeconomics;
- Hazardous materials;
- Unavoidable adverse impacts;

- Relationship between short-term use of the environment and maintenance and enhancement of long-term productivity; and
- Irreversible and irretrievable commitments of resources.

The topics listed below either would not be affected or would be affected only negligibly by the alternatives evaluated in this FEIS. Therefore, these topics have been dismissed from further analysis. A detailed rationale for dismissing these and other impact topics is given in Chapter I: *Purpose of and Need for Management Action*.

- Water quantity;
- Special status plants;
- Traditional cultural (ethnographic) resources;
- American Indian Religious Freedom Act;
- Museum collections;
- Wilderness;
- Lightscapes;
- Soundscapes;
- Prime and unique farmlands;
- Energy consumption (carbon footprint of alternatives is discussed in Air Quality);
- Climate change; and
- Environmental justice.

# G. IMPACT ASSUMPTIONS

Acreage impacts and other quantified impacts provided within the analysis are preliminary. This information is provided to convey the relative differences in impacts among alternatives and is from multiple sources, including the 30 and/or 50 percent road designs provided by Federal Highway Administration (FHWA) to the North Cascades NPS Complex. Final impact numbers would likely be within ten percent of the numbers provided in Table i-1: *Impact Assumptions* and throughout this document. Estimated road impacts have been rounded to the nearest half or whole acre, although some specific differences are given within, depending on the impact being discussed. Impacts associated with erosion protection measures and recreational features have been derived from designs based on the anticipated area that would be affected. Implementation of these measures would have similar impacts but could be slightly more or less than the approximate impact figures identified. Some additional assumptions implicit in the environmental analysis are also contained in the introduction to Chapter IV: *Environmental Consequences*.

### Table i-1: Impact Assumptions

| | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 |
|---|---|---|---|---|---|
| Stehekin Valley Road proposed paving mileage | 9.2 miles | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 |
| Stehekin Valley Road rehabilitation mileage (Harlequin Bridge to Winter Turnaround) | 4.9 mi | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 |
| Actual area (Alt 1: road length × 14 ft, Alts 2 - 5: x 16 ft) | 8.3 ac | 9.4 ac | Same as Alt 2 | Same as Alt 2 | 9.6 ac |
| Site-specific road improvements (pullouts, winter turnaround,Wilson Creek, Thimbleberry Creek) | 2.3 ac | 2.4 ac | 2.4 ac | Same as Alt 1 | Same as Alt 2 |
| Stehekin Valley Road Reroute | N/A | 13 ac | 13 ac | N/A | 13 ac |
| Reroute Access Connector | N/A | N/A | N/A | N/A | 1.0 - 1.2 ac |
| McGregor Meadows Access Road | N/A | 1.3 ac (0.8 mi) | Same as Alt 2 | N/A | Same as Alt 2 |
| Estimated lands available for exchange | 37 ac | 24 ac | Same as Alt 2 | Same as Alt 2 | 29 ac |
| Number of barbs (acres) | 0 | 6 - 8 (0.5) | 4 (0.3) | 16 - 17 (1.1) | Same as Alt 2 |
| Number of logjams (acres) | 0 | 2 (0.1) | 5 (0.3) | 3 (0.1) | Same as Alt 2 |
| Maintenance / housing relocation | 5 - 8 ac | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 |
| Recreational improvements | 3.1 ac | 3.6 ac | 3.4 ac | 3.5 ac | Same as Alt 2 |
| **Restoration** | | | | | |
| a. Riparian | 1.5 ac | 4.1 ac | 3.9 ac | 2.9 ac | Same as Alt 2 |
| b. Upland | 3.6 ac | 4.4 ac | 3.7 ac | 3.7 ac | Same as Alt 2 |
| c. Bioengineering (barbs and logjams) | n/a | 0.6 ac | 0.6 ac | 1.2 ac | Same as Alt 2 |
| Total restoration (a+b+c) | 5.1 ac | 9.1 ac | 8.2 ac | 7.8 ac | Same as Alt 2 |
| **Total disturbance** | | | | | |
| | 10 ac (new)<br>37 ac (LPP)<br>12 ac (existing) | 23 ac (new)<br>24 ac (LPP)<br>8 ac (existing) | 23 ac (new)<br>24 ac (LPP)<br>9 ac (existing) | 11 ac (new)<br>24 ac (LPP)<br>12 ac (existing) | 24 ac (new)<br>29 ac (LPP)<br>8 ac (existing) |

## H. SUMMARY OF ENVIRONMENTAL CONSEQUENCES

NEPA requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented. These analyses provide the basis for comparing the effects of the alternatives. NEPA requires consideration of context, intensity and duration of impacts, indirect impacts, cumulative impacts, and measures to mitigate impacts. In addition to determining the environmental consequences of the preferred and other alternatives, NPS *Management Policies 2006* (NPS 2006a) and Director's Order 12 (NPS 2001a) require analysis of potential effects to determine if actions would impair park resources.

A summary of major and other key adverse and beneficial impacts that would occur under the alternatives is found in Table i-1: *Impact Assumptions*. These impacts are further defined in Chapter IV. In Table IV-16: *Impact Comparison Chart*, the range of major, moderate, minor, and negligible impacts are described. For each impact topic, effects of the alternatives are assessed by context, type, duration, area, and intensity, and each section includes a discussion of cumulative impacts.

Alternatives 2 and 5 have 19 major benefits in 13 impact categories, while six major adverse impacts occur in four categories (Figure i-12: *SRCIP Major Beneficial and Adverse Impacts Alternatives 2 and 5*). One of the major impacts is short-term, and involves initial disturbance to vegetation and soils from road reroute construction. Multiple benefits to some impact categories in Alternatives 2 and 5 would occur in soils and vegetation, hydraulics and streamflow, water quality, floodplains, and NPS operations (Figure i-12). Some of the actions in these alternatives, such as the maintenance relocation and the road reroute, have both major benefits, and hazardous materials impact categories. An updated Land Protection Plan in Alternatives 2, 3, 4 and 5 would create opportunities for private landowners and the NPS to relocate some of the most threatened floodplain development. As shown in Figure i-13: *SRCIP Major Beneficial and Adverse Impacts Alternatives 1 and 4*, Alternatives 1 and 4 have fewer major beneficial effects (10) than Alternatives 2, 3 and 5.

Most of the major adverse impacts in Alternatives 2, 3 and 5 would be associated with short- and long-term disturbance to land use, vegetation and soils, water quality, and wildlife during construction of the new road reroute around McGregor Meadows and NPS facilities. The reroute includes the possibility of disturbing northern spotted owls. Alternatives 1 and 4 avoid immediate encroachment on the owl activity area, but over the long term, anticipated channel avulsion in the valley near the area would likely require additional activity to protect the road and could disturb the owls.

All of the action alternatives would add to cumulative effects on the Stehekin River from installation of new erosion protection structures. Alternatives 2 and 5 would add six to eight rock barbs at three sites, an increase in the total number of barbs on the river from the current 30, and an increase in affected streambank from 6.5 to 7.8%. At Frog Island and Wilson Creek, the road is currently at the edge of its channel migration zone, and the added barbs would be viewed as a moderate impact. Proposed barbs at the Stehekin River mouth are along a terrace in the middle of the channel migration zone, and therefore would have a larger impact than at the other two sites. At Frog Island and the Stehekin River mouth, impacts would be reduced because rock barbs and bioengineering would replace existing rip-rap.

**Figure i-12: SRCIP Major Beneficial and Adverse Impacts Alternatives 2 and 5 (Preferred)**

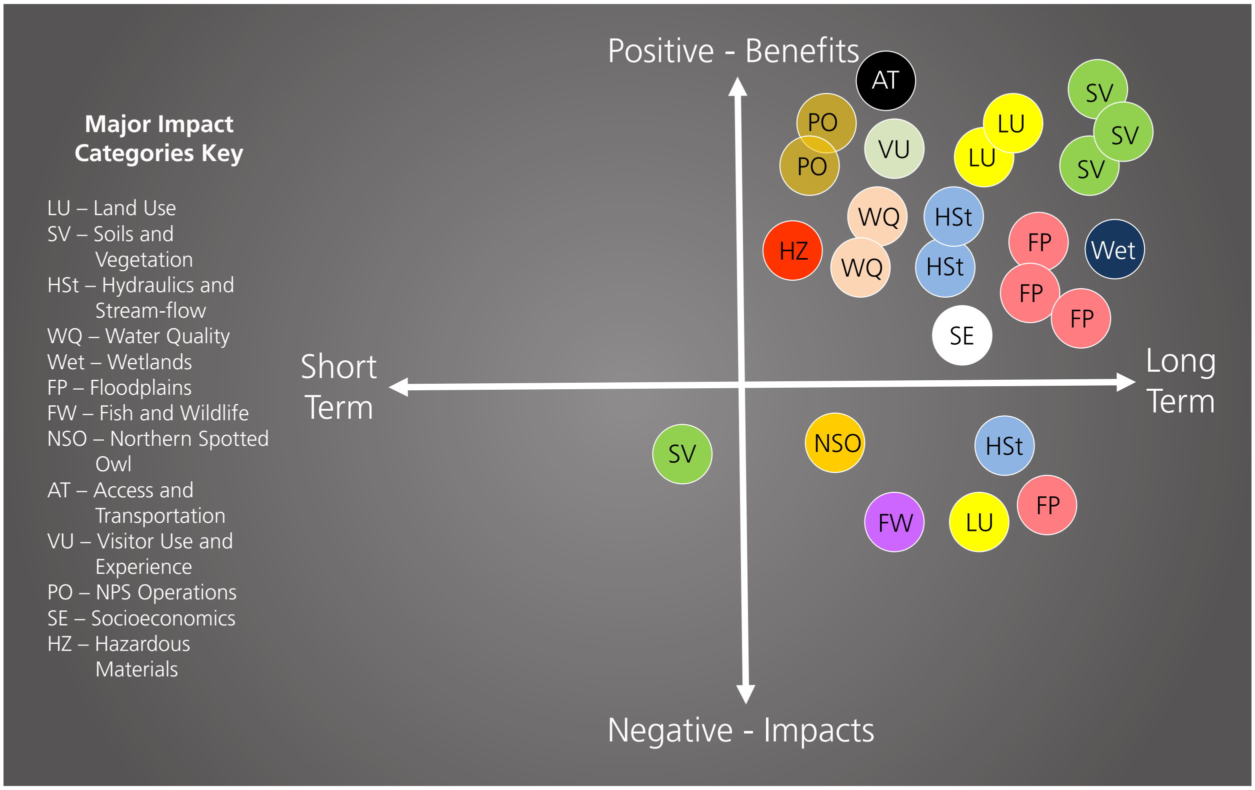
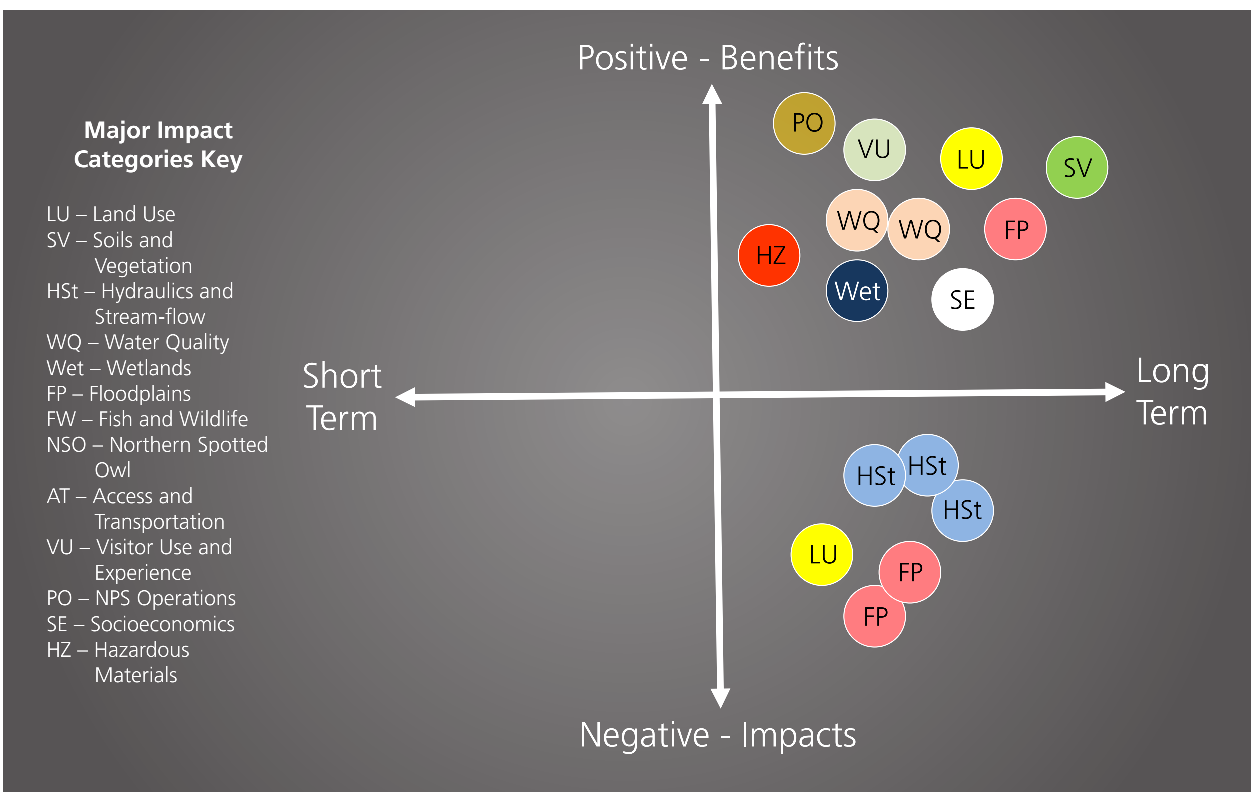
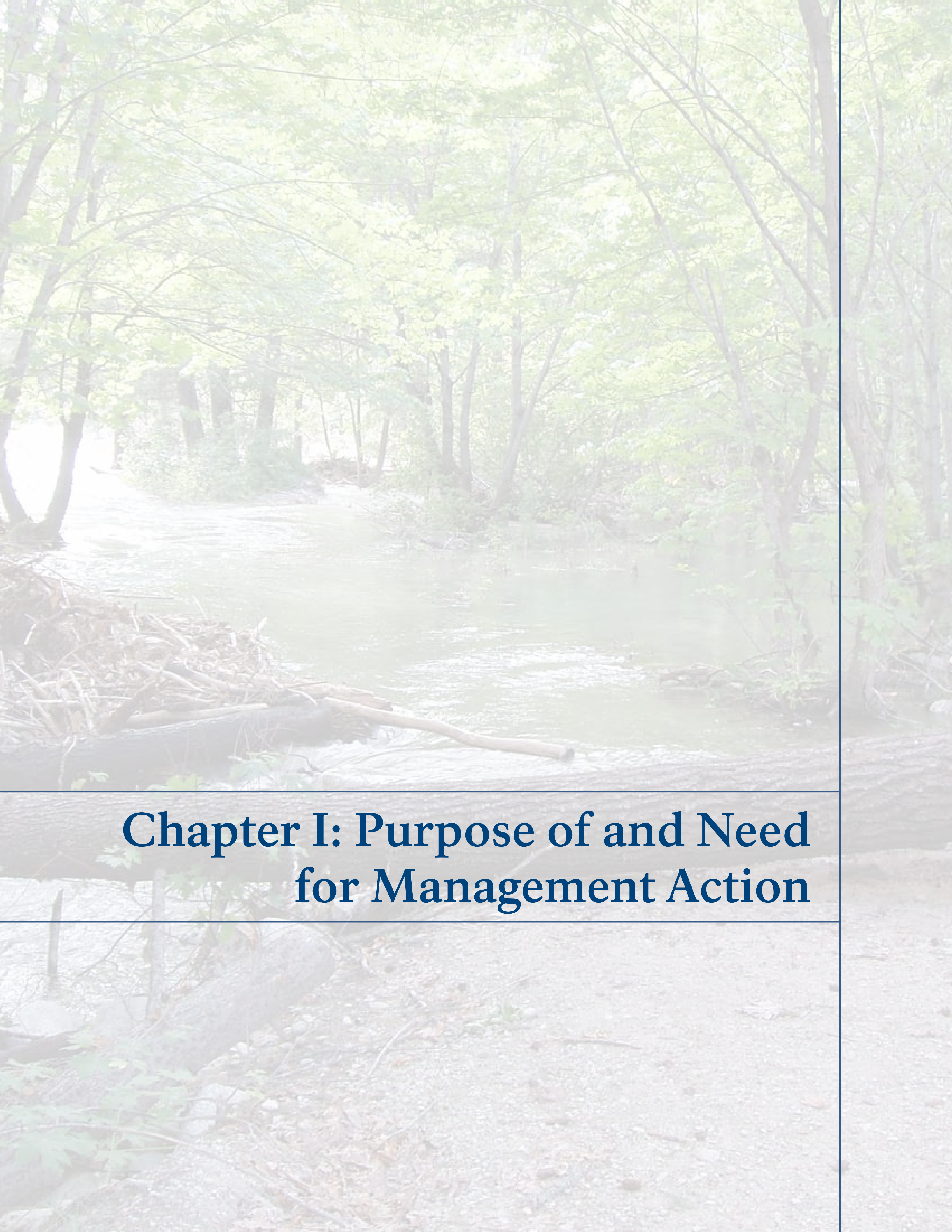



**Figure i-13: SRCIP Major Beneficial and Adverse Impacts Alternatives 1 and 4**



Alternatives 2, 3 and 5 would have similar cumulative impacts on river processes, but in Alternative 3 large engineered logjams would be installed instead of some rock barbs. By focusing on maintaining the Stehekin Valley Road in place, Alternative 4 would add to cumulative impacts to the river by adding 16-17 new rock barbs, increasing the amount of affected streambank from 6.5 to 9.2%. While Alternative 1 proposes the fewest new erosion protection structures, it would add more fill to the floodplain at McGregor Meadows to elevate the road, and would restrict the river from more of its floodplain, similar to, but less than, Alternative 4.



# Chapter I: Purpose of and Need for Management Action

Stehekin Valley Road at Milepost 10 after the 2003 flood.

# CHAPTER I: PURPOSE OF AND NEED FOR MANAGEMENT ACTION

## A. PURPOSE AND NEED

Recent major floods and resultant channel changes on the lower Stehekin River have intensified flood and erosion threats to National Park Service (NPS) facilities and are impacting natural resources and private property within Lake Chelan National Recreation Area (Lake Chelan NRA). The three largest recorded floods on the Stehekin River since 1911 have occurred within the past 16 years, and in response to this increased frequency of major floods, the NPS has spent more than $3 million to protect public roads and facilities and to repair flood damage. Roads, visitor and administrative facilities, and private development once thought to be safe from the river are now threatened. Because of the current impacts and future risks associated with these unprecedented conditions, the primary purposes of the proposed actions within this Stehekin River Corridor Implementation Plan / environmental impact statement (SRCIP/EIS) are to:

- Sustainably operate and maintain NPS administrative facilities, public access (via roads and trails), and campgrounds.
- Protect water quality, scenic values, habitat, and natural processes of the Stehekin River.
- Partner with the Stehekin Community to provide services, facilities and experiences for visitors.

These purposes meet the goals and direction provided in the 1995 *Lake Chelan National Recreation Area Final General Management Plan Environmental Impact Statement* (GMP) (NPS LACH 1995a).

This implementation plan is needed to address several interrelated issues, including to (1) respond to the increased magnitude and frequency of flooding, (2) implement and clarify 1995 GMP guidance, (3) sustain public facilities while protecting natural resources, (4) manage limited funding, and to (5) respond to private landowners.

The NPS is the lead agency in the development of this Environmental Impact Statement (EIS) and has identified a need to evaluate comprehensive and sustainable management strategies and linked public-private actions to address the consequences of flooding. The Federal Highway Administration (FHWA) is a cooperating agency because they will design and provide funds for roadway construction and will administer construction contracts for proposed actions.

### 1. Primary Issues

*(1) Respond to the Increased Magnitude and Frequency of Flooding.*

Prior to the late 20th century, the Stehekin River was prone primarily to spring snowmelt flooding. Since the 1970s, however, the Stehekin River has become prone to large rain-on-snow floods, which rise quickly and occur during the fall from mid-October through December.

Hydrologic data collected on the river since 1911 confirm the statistical significance of this shift, as analyzed by the U.S. Geological Survey (USGS). The severe floods in 1995, 2003, and 2006 have led to significant changes in the Stehekin River channel and redefined the boundaries for the 100-year flood. As a result, recreational and administrative facilities and developments once thought to be safe from the river are now threatened by flooding and bank erosion, while other sites in the floodplain have been compromised by larger, more frequent floods. Until now, the NPS has addressed problems on a case-by-case basis throughout the valley with the passage of each of these large floods.

*(2) Implement and Clarify 1995 GMP Guidance.*

The GMP provides broad management guidance for Lake Chelan NRA, as well as some specific prescriptions to mitigate the risks and consequences of flooding (NPS LACH 1995a). As a programmatic document, the GMP lacks the specific management direction needed to respond to the current circumstances imposed by the recent floods. Specific actions called for in the GMP that would be implemented in this plan include replacement and relocation of the maintenance facility and NPS housing out of the floodplain (NPS Tracts 06-118, 06-104, 06-121, and 06-122), construction of the Lower Valley Trail, and continued maintenance of vehicle access on the Stehekin Valley and Company Creek roads. This implementation plan is needed to inform the location, design, construction, and implementation of these actions. Guidance provided by the GMP needs to be updated and clarified to reflect the dramatic increase in woody debris since 1995 and recognition of the influence of Chelan County Public Utility District (Chelan PUD) operations for power generation on the level of Lake Chelan and the lower Stehekin River. This plan is also needed to evaluate and publicly disclose the direct, indirect, and cumulative impacts of these actions on the resources and values of Lake Chelan NRA.

*(3) Sustain Public Facilities While Protecting Natural Resources.*

Management action is needed to provide long-term use and access to administrative and recreation facilities. Despite erosion protection and flood protection efforts by the NPS and private landowners, bank erosion continues to threaten public and private property. Channel changes have increased the rate of erosion and frequency of flooding at some sites, while decreasing erosion rates at others. Integrated management actions such as facility replacement and relocation, site-specific bank hardening, and limited manipulation of woody debris in the Lake Chelan backwater zone now need to be considered to ensure the long-term sustainability of infrastructure and protection of resources. Management of large wood and proliferation of bank-protection measures have the potential to impact federally- and state-listed species and to increase the spread of nonnative plants. These conditions underscore the need for an updated assessment of erosion and flood protection measures in the lower Stehekin Valley.

*(4) Manage Limited Funding.*

The NPS has spent more than $3 million to react to recent flood damage to maintain vehicle access on the Stehekin Valley and Company Creek roads and to respond to new threats on an event-by-event basis. A comprehensive and integrated set of strategies and tactics to meet the goals of the GMP and to mitigate the risk and impacts from flooding is urgently needed to enable the NPS to use limited funds for the maximum benefit of Lake Chelan NRA. Without this comprehensive approach, the NPS would continue to respond on a case-by-case basis, which costs more and could threaten natural resources and public safety.

*(5) Respond to Private Landowners.*

Lake Chelan NRA includes approximately 417 acres of private land, much of which lies within the floodplain and channel migration zone of the Stehekin River. (The channel migration zone is where the river has historically migrated in the valley over the past 1,000 years.) Developments at McGregor Meadows and near the river mouth are particularly vulnerable because of their density and their location in more active river reaches. These reaches, or sections of the river, have extensive new gravel deposits and rapidly growing logjams as a result of recent floods. The high monetary and environmental costs of bank-protection and flood-mitigation measures continue to threaten the long-term sustainability of Lake Chelan NRA resources and private property. At the river mouth, accumulation of logs in the backwater zone of Lake Chelan has led to deeper floodwater in parts of the floodplain. The recent flooding has hastened channel migration; damaged or destroyed several cabins; incorporated debris and effluent from septic systems into the river; and increased the flood risk to private lands previously not threatened by flooding. The NPS is concerned that these circumstances will continue to adversely affect Lake Chelan NRA and Stehekin River natural resources and values. The primary means by which the NPS can address this concern is via the *Lake Chelan National Recreation Area Land Protection Plan* (LPP) (NPS LACH 1995b). The LPP identifies and prioritizes private lands for acquisition or exchange from willing sellers. Last updated in 1995, the plan is being revised to address new river channel and floodplain conditions, and to create new funding opportunities to help protect Lake Chelan NRA and the Stehekin Community.

## 2. Decision to be Made

This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and its implementing regulations (40 CFR Parts 1500 - 1508); NPS *Management Policies 2006* (NPS 2006a); NPS *Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making* (*Director's Order 12*) (NPS 2000a) and handbook; Section 106 of the National Historic Preservation Act (NHPA) of 1966 as amended, and its implementing regulations (36 CFR Part 800); related guidance; and applicable executive orders.

Photo 6 – Flooding of NPS Maintenance Area in 2006.

NEPA requires the documentation and evaluation of potential impacts resulting from federal actions on lands under federal jurisdiction. An EIS discloses the potential environmental consequences of implementing the proposed action and other reasonable and feasible alternatives. NEPA is intended to provide decision makers with sound knowledge of the environmental consequences of the alternatives available to them. In this case, the superintendent of Lake Chelan NRA (North Cascades NPS Complex) and the Pacific West Regional Director are faced with deciding which alternative to select from the SRCIP to most effectively implement the 1995 GMP, and to meet the goals of this plan.

## Interdisciplinary Analysis / Technical Committee

Analysis of impacts to wildlife, plants, and cultural resources was conducted primarily by NPS staff. The U.S. Fish and Wildlife Service (USFWS) was consulted on impacts to threatened and endangered species, including the northern spotted owl. In addition, because of the large amount of hydrologic and geologic data on the Stehekin River, the complexity of the Stehekin River system, and the number of issues, sites, and actions considered in this plan, the NPS established a technical committee for this planning effort. The committee included representatives from Chelan County, Chelan PUD, U.S. Army Corps of Engineers, USFWS, Washington Departments of Ecology and Fish and Wildlife, and Geomax PC, a private consulting engineer familiar with Stehekin. The technical committee provided scientific and regulatory information related to long-term river and floodplain management in the lower Stehekin Valley.

To comply with the Federal Advisory Committee Act (1972), the purpose of the technical committee was not to advise the NPS on plan development, but rather to assess technical information and the applicability of regulations regarding proposed management alternatives and actions. Meetings of the technical committee were held to identify issues and to review alternative development in spring 2008; to conduct a field review of potential actions and sites in summer 2008; and to analyze impacts associated with specific alternative actions.

Photo 7 – Destruction of private cabin and damage to upper Company Creek Road during the 2003 flood.

## 3. Project Area

The project area includes the lower Stehekin Valley from High Bridge to the head of Lake Chelan, including Weaver Point (Figure I:1 *Project Area*). No actions are considered in adjacent wilderness, which is located above about 1,640 feet in elevation in the lower valley, more than 300 feet above the Stehekin River floodplain.

Lake Chelan NRA is located in north central Washington State and is bordered by North Cascades National Park, Wenatchee National Forest, and two wilderness units administered by Okanogan-Wenatchee National Forest (Figure I-1: *Project Area* and Figure I-2: *Lower Stehekin Valley*). Approximately 90 percent of Lake Chelan NRA (56,000 acres) is included within the Stephen Mather Wilderness Area (NPS NOCA 2000b). Lake Chelan NRA is one of three NPS units managed as part of the North Cascades NPS Complex.

The Stehekin River flows into Lake Chelan. At 1,450 feet, Lake Chelan is the third deepest lake in North America and a major tourist destination. While most of the Lake Chelan and Stehekin watersheds are undeveloped because of designated wilderness, several Lake Chelan tributaries have been developed. Noteworthy among these is Railroad Creek, which flows into the lake at Lucerne. Railroad Creek is also the location of a superfund site because of extensive tailings piles from a former copper mine. There is also extensive development in the community of Chelan at the opposite end of the lake from Stehekin.

The Stehekin Valley was originally considered for national status as early as 1906. Senate Report 700 (October 31, 1967) recommended that the area become a national recreation area (rather than a national park) and to include within it the private lands of the Stehekin Valley, because it was believed that the properties were principally owned by descendants of the early homesteaders and because services could be provided to visitors by the remote Stehekin Community. The hunting lobby, however, pushed hardest for the national recreation area classification (Louter 1998:50 - 52). Senate Report 700 states:

> *Designate the lower Stehekin River Valley and upper Lake Chelan areas the Lake Chelan National Recreation Area instead of a part of the national park. Many of the year long residents of the Stehekin Valley are descendants of the original homesteaders. Some 1,700 acres, mostly on the valley floor, are in private ownership, and in the past several decades a number of summer homes have been built. The only access to the community is by foot, horseback, boat, or plane, even though there is in existence a road of some 25 miles extending from the village up the valley. The lake, likened by most to the spectacular fjords of Norway, will serve as the primary access for park and recreation area visitors approaching from the southeast. The village and lower valley, therefore, will have considerable use, and development to accommodate these visitors will be necessary. The Stehekin Valley, the Rainbow Creek Valley, and Rainbow Ridge traditionally have been used by high country big game hunters.*

The Stehekin Valley is a glacial valley that begins at the crest of the Cascade Range near Cascade Pass (North Cascades National Park) and ends where the river flows into Lake Chelan. The developed lower valley is remarkable for the rapid change in river pattern within seven miles from boulder-strewn gravel bars at McGregor Meadows to sandbars at the lake edge. Tributaries enter the lower Stehekin Valley as hanging valleys, with deep gorges containing thundering waterfalls. Lake Chelan's level was raised 21 feet by a hydroelectric/flood-control dam in the 1920s. Approximately the upper five miles of Lake Chelan and the lower nine miles of the Stehekin River are included in Lake Chelan NRA.

## Figure I-1: Project Area

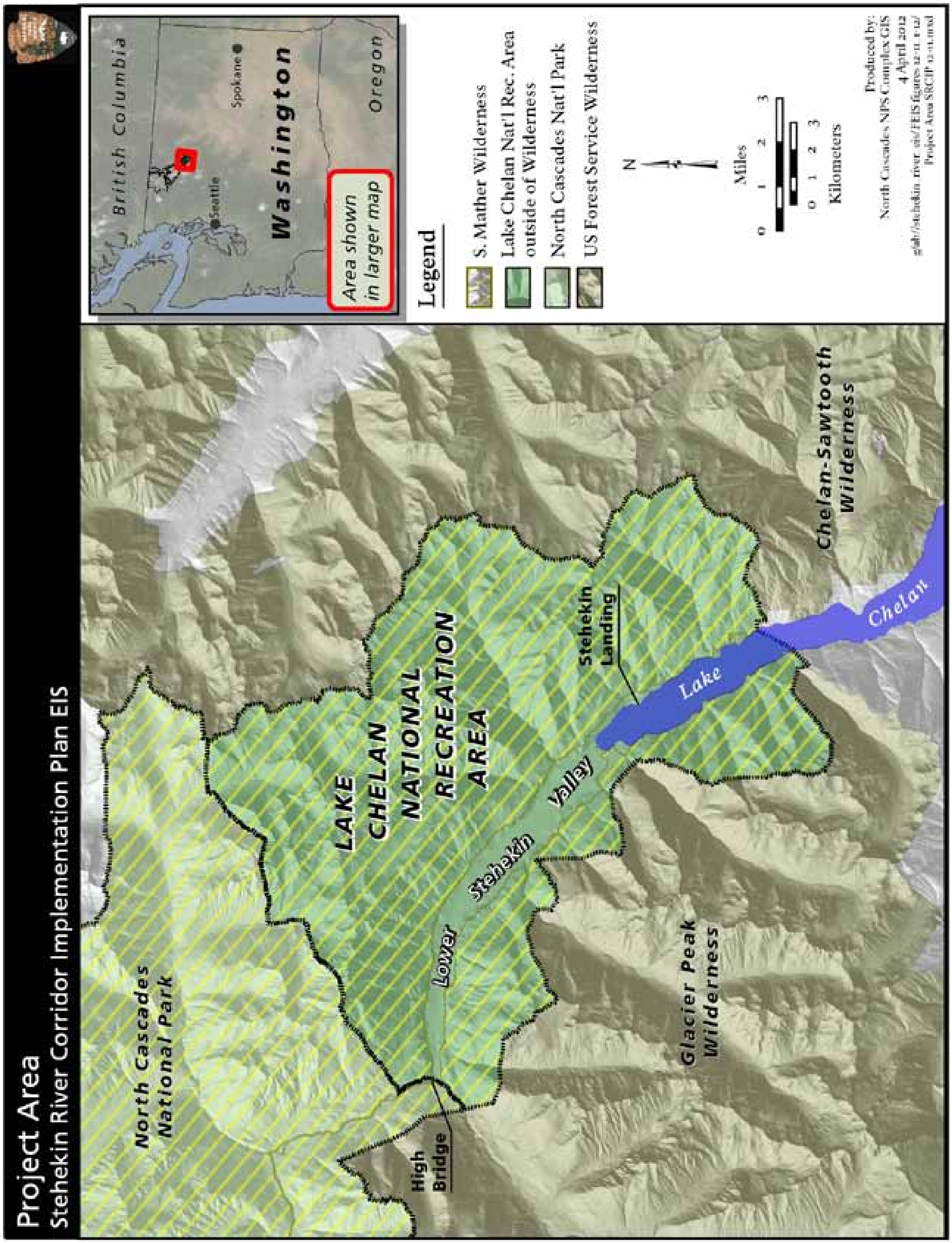
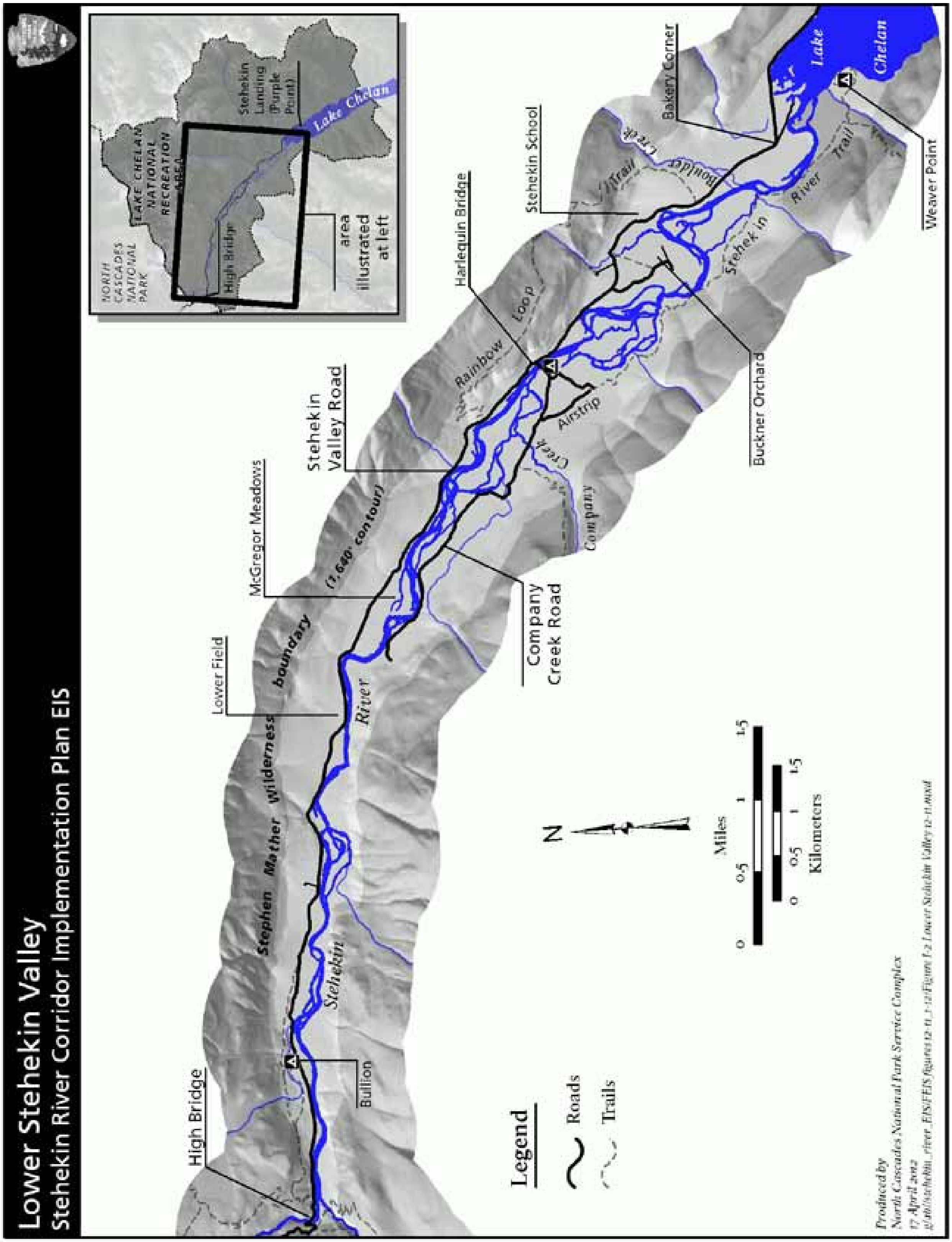


**Figure I-2: Lower Stehekin Valley**



# 4. Purpose and Significance of Lake Chelan National Recreation Area

## Purpose

The purpose of Lake Chelan NRA is to "…provide for public outdoor recreational use and enjoyment …and for conservation of the scenic, scientific, historic and other values" (Enabling Legislation for Lake Chelan NRA, Public Law 90-544, October 2, 1968). Today Lake Chelan NRA functions as a gateway to more than two million acres of roadless wilderness. Management is dedicated to conserve the scenery for outdoor recreation and education, the natural and cultural values of the lower Stehekin Valley, Lake Chelan and surrounding wilderness, while respecting the remote Stehekin Community (NPS NOCA 2006b).

## Significance

The following statements from the recently completed North Cascades NPS Complex Foundation Statement (NPS NOCA 2006b) are those that apply specifically to Lake Chelan NRA:

- Within Lake Chelan NRA, Stehekin is a private community that provides visitors with an opportunity to see and experience life in a remote setting that is not accessible by roads and is surrounded by wilderness.
- Set in a glacier-carved trough between steep valley walls, Lake Chelan is the nation's third deepest lake. Fed by glacial melt and the Stehekin River, it is known for its exceptionally cold and clear water.
- Lake Chelan NRA provides a spectrum of recreational opportunities that transition from highly mechanized to primitive as one moves from the lake, up the Stehekin Valley, and into the wilderness.

Management Objectives for Lake Chelan NRA include:

- **Natural Resource Management:** Manage Lake Chelan NRA as an integral part of a larger regional ecosystem, and protect and restore the components and processes of naturally evolving park ecosystems, including the natural abundance, biodiversity, and ecological integrity of plants, animals, water and soil to the extent public safety considerations permit (NPS LACH 1995a:19).
- **Cultural Resource Management:** Protect and interpret the park's archeological, historic and ethnographic resources. Treatment of historic properties would be undertaken in accordance with NPS policies and the park's cultural resource management plan in consultation with the Washington State Historic Preservation Officer, the Advisory Council on Historic Preservation, and other interested persons as appropriate under 36 CFR 800… (NPS LACH 1995a: 28).
- **Visitor Experience:** Emphasize selected opportunities that focus on natural, cultural, and recreational values, through both structured and unstructured ways and both solitary and social means. Visitors encounter facilities and services in a rural Stehekin Community context where needs are balanced with preservation of a nearly pristine natural environment (NPS LACH 1995a: 29).

# B. BACKGROUND

This SRCIP / FEIS is a response to the effects of the increased frequency and magnitude of flooding on the Stehekin River and the adverse effects this flooding has had on NPS infrastructure and private lands in the lower Stehekin Valley (Figure I-3: *Existing Conditions*).

The following key characteristics of the Stehekin Valley require careful planning to avoid the effects of repeated flood damage:

1. The flood prone nature of the Stehekin River, which is due to its geography, watershed shape, and steep slopes. Further, the river has the potential for the formation and sudden failure of debris dams in the narrow canyons above High Bridge)
2. Channel instability from the transport of large amounts of water, gravel, and large wood
3. A shift in the last 30 years from spring floods to larger, more frequent fall floods
4. A history of river manipulation, including effects from the Lake Chelan Dam, and the addition of erosion protection measures to the river over the last 20 years. Riparian resources and water quality have been adversely affected as cabins, effluent from septic systems, and other debris are incorporated into the river during floods.

## 1. History of Stehekin River Flooding

Inventorying, monitoring, and research have been conducted primarily on the lower ten miles of the river above Lake Chelan. The USGS flow gauge near Boulder Creek was installed in 1911 and is the basis for understanding flood magnitude and frequency in the watershed.

The Stehekin River watershed encompasses approximately 220,000 acres (344 square miles). Public lands comprise 99 percent of the watershed and includes the Glacier Peak and Stephen Mather wilderness areas. Steep slopes, a dense network of tributary streams, and the location of the river's headwaters along the wet Pacific Crest have led to the frequent and rapid rise of floodwaters on the river, perhaps more so than any other river in eastern Washington (Figure I-4: *Timing and Magnitude of Peak Discharge for the 2003 Flood on Six North-Central Washington Rivers*).

Just above the developed lower valley, the Stehekin River is joined by three major tributaries within five miles. Deep bedrock canyons within this zone deliver water, sediment, and large wood quickly to the wide lower valley below High Bridge. These narrow box canyons are potential sites for the formation and failure of temporary debris dams, which add an unpredictable element to flooding on the Stehekin River. Some anecdotal and observed evidence indicates that the temporary formation and rapid failure of a debris dam on the Stehekin River above High Bridge led to the record peak flow of 25,600 cubic feet/second (cfs) in October 2003 (Table I-1: *Chronology and Features of the Ten Largest Floods on the Stehekin River*).

## Figure I-3: Existing Conditions

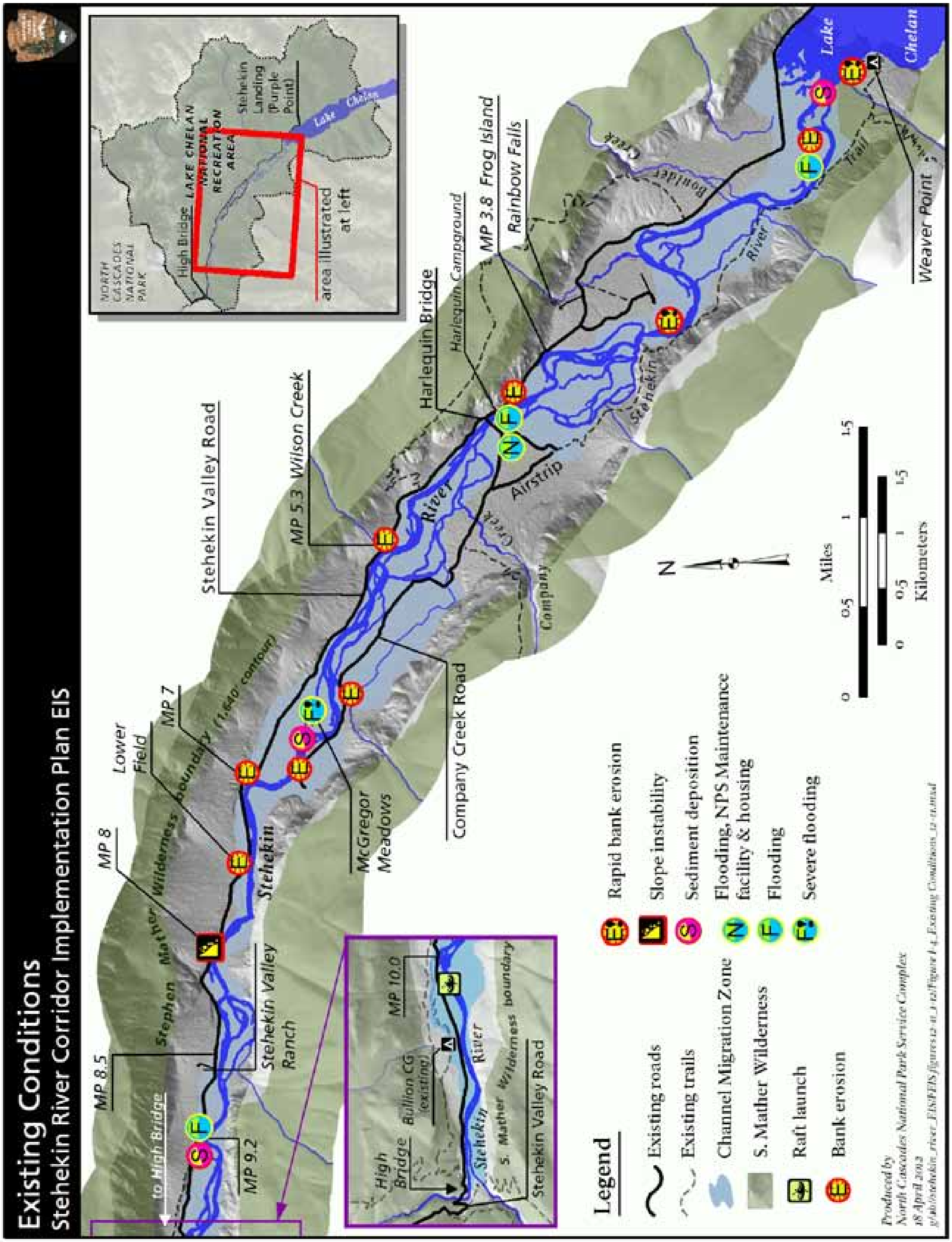


**Figure I-4: Timing and Magnitude of Peak Discharge for the 2003 Flood on Six North-Central Washington Rivers**

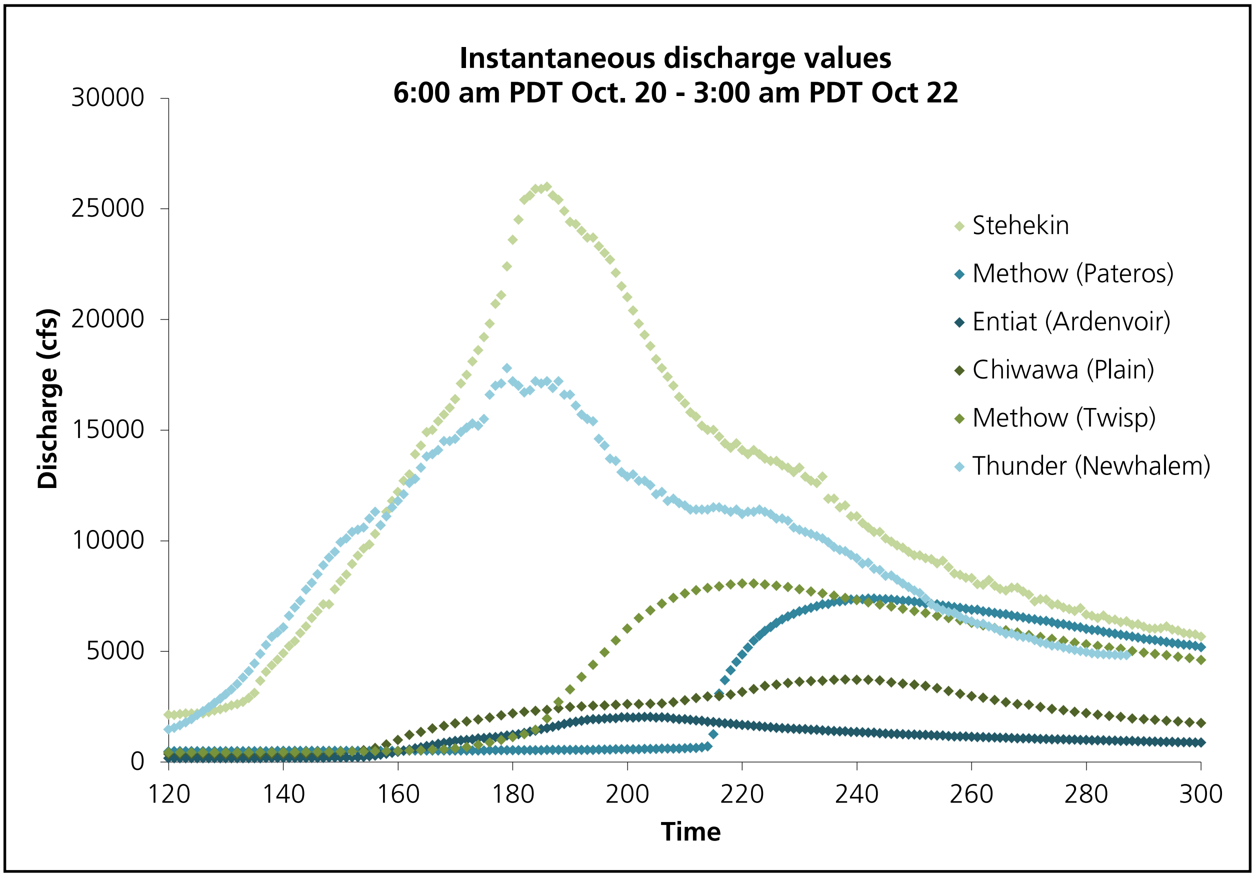



**Table I-1: Chronology and Features of the Ten Largest Floods on the Stehekin River**

| Date | Flood Type | Discharge (cfs) | Recurrence Interval[a] |
|---|---|---|---|
| October 20, 2003 | Intense rainfall | 25,600[b] | 100 - 500 years |
| November 29, 1995 | Rain on snow | 20,900 | 100 years |
| November 07, 2006 | Rain on snow | 19,100 | 100 years |
| May 29, 1948 | Snowmelt | 18,900 | 100 years |
| November 07, 1948 | Rain on snow | 18,400 | 50 - 100 years |
| December 26, 1980 | Rain on snow | 17,300 | 50 years |
| June 16, 1974 | Snowmelt | 16,600 | 25 years |
| November 24, 1990 | Rain on snow | 14,700 | 10 years |
| June 02, 1968 | Snowmelt | 14,400 | 10 years |
| June 10, 1972 | Snowmelt | 14,400 | 10 years |
| June 21, 1967 | Snowmelt | 13,900 | 10 years |

[a]*Flood recurrence interval based on separating spring and fall floods as discussed below (Table I-2 on page page 16).*

[b]*Flood discharge estimated due to gauge malfunction.*

## 2. Channel Instability Associated with the Transport and Deposition of Gravel

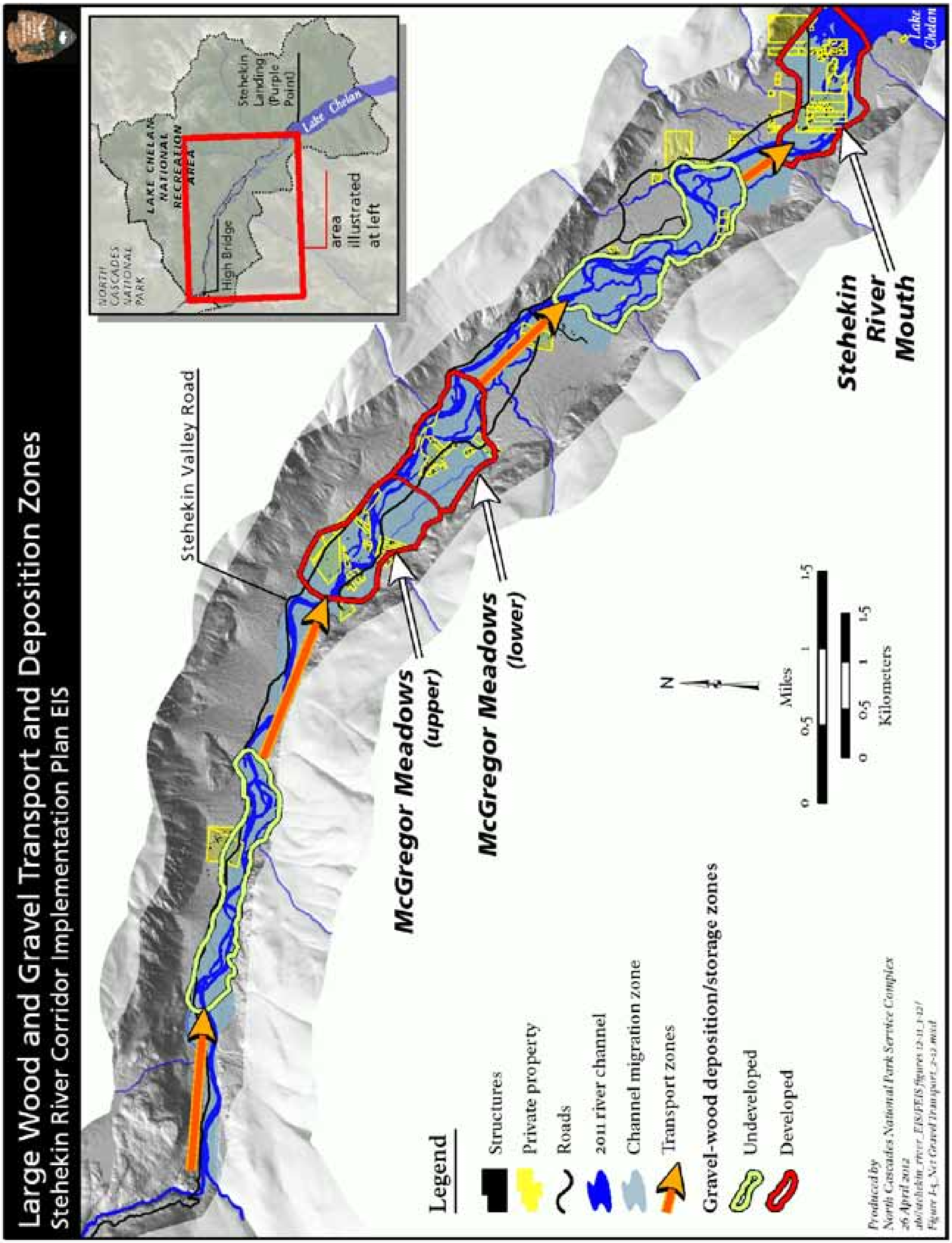
The gradient of the Stehekin River at its confluence with Agnes Creek is about 80 feet per mile. This decreases to 50 feet per mile above McGregor Meadows, and to 25 feet per mile just above Lake Chelan. Within this zone, decreases in channel slope and valley width cause the river to deposit coarse gravel during big floods. Movement of the river away from these deposits leads to bank erosion. Four distinct areas of net gravel deposition have been identified in the lower Stehekin Valley (Figure I-5: *Large Wood and Gravel Transport and Deposition Zones*).

The McGregor Meadows area is the site of massive gravel deposition during floods because the valley widens threefold in this reach, which results in a drop in gradient, gravel deposition, and bank erosion. The next two gravel deposition and channel instability zones occur above and between the Company, Rainbow, and Boulder Creek alluvial fans. These fans constrict the river and cause an increase in channel gradient and stability. River miles 1.2-1.8, 3.5 - 4.2, and 6.6 - 7.2, where relatively straight, steep sections of the river are net transport zones for sediment and large wood, are also areas of relative channel stability. In contrast, the wood and sediment storage zones between these fairly stable reaches are characterized by the existence of massive logjams, multiple side channels, and channel instability (bank erosion). The fourth major zone of deposition and channel instability in the lower Stehekin Valley is where the river meets the backwater of Lake Chelan. A 2000 Chelan PUD study showed that at full pool the lake influence on the river extended about a quarter mile upstream during a 100-year flood (Chelan PUD 2000).

Bank erosion and storage of gravel on the lower Stehekin River have been dramatic in the past 50 years. Annual total sediment load is estimated at 32,000 cubic yards per year, with about 17 percent, or 5,440 cubic yards per year, transported along the bed of the river as gravel (Riedel pers. comm. 2008). Bank erosion measured since 1962 at 16 sites averaged about 25 feet, with some sites stable and others with as much as 110 feet of erosion. Bank erosion at all sites yielded an estimated 500,000 cubic yards of gravel to the channel over 47 years. While large amounts of gravel are stored in the lower valley, it appears some gravel has moved through the river and into Lake Chelan.

Photo 8 – Stehekin Valley Road at Milepost 10 after the 2003 flood.

**Figure I-5: Large Wood and Gravel Transport and Deposition Zones**




*Note development in two of these zones (McGregor Meadows and Stehekin River Mouth), shown in yellow.*

The massive movement and deposition of gravel makes consideration of periodic dredging as a tool for addressing the flood threat highly problematic, expensive, and unsustainable (Riedel 2009). Based on estimates of gravel deposition since 1995 at two important, half-mile-long sections of the river (McGregor Meadows and near the Stehekin River Mouth), the U.S. Army Corps of Engineers estimated a one-time cost of about $12 million for channel deepening and for removal and transport of gravel to Company Creek Pit (see "D. Alternatives and Actions Considered but Dismissed" and Appendix 18). This cost would need to be repeated to remove gravel continuously transported and deposited by the river.

Gravel deposited along the channel causes large logs to accumulate during floods. Due to the rapid increases in wood on the river, the NPS conducted three comprehensive surveys of large wood accumulations (1984, 2000, and 2007), which have documented a major increase in large woody debris accumulation on the lower Stehekin River (Figure I-6: *Stehekin River Large Wood Monitoring 2000-2007*).

In 1984, about ten years after the last large-scale logjam removal, there were 128 logjams with a total volume of about 22,000 cubic yards. In the 2000 survey, there were 101 logjams with a total volume of about 130,000 cubic yards. In 2007, there were 166 logjams consisting of ten or more pieces on the lower river that contained a total volume of 400,000 cubic yards (Riedel 2007). The substantial increase in large woody debris is attributed primarily to the passage of the three major floods in 1995, 2003, and 2006. The accumulated wood is now viewed as a benefit because it creates pools (habitat for aquatic life), slows the velocity of water in the channel, facilitates the spread of floodwater into side channels and wetlands, and provides other wildlife habitat.

To some extent, the increase in wood below Harlequin Bridge in the last 40 years may appear unusually large because up to the early 1970s, the large woody debris was occasionally removed. In 1972, the U.S. Army Corps of Engineers, under contract with the Federal Disaster Assistance Administration (FDAA), the precursor to the Federal Emergency Management Administration (FEMA), removed most large logjams on the Stehekin River below Harlequin Bridge. Removal of large woody debris was funded in an attempt to reduce the flood and erosion risk to private property within Stehekin. Federal and state regulations have changed to generally discourage large scale manipulation like this because it is recognized as not financially, or ecologically, sustainable.

## 3. Shift from Spring Peak Flooding to Fall Peak Flooding

Analysis of nearly 100 years of flow records indicates that in about 1975 the Stehekin River switched from a system dominated by spring snowmelt floods to one dominated by larger, more frequent, fall rain-on-snow floods. Illustrating this shift, the three largest floods on record have occurred within the past 16 years and were fall events (Figure I-7: *Magnitude and Timing of the Annual Peak Flood on the Stehekin River*).

The importance of this shift is that floods have become larger and more frequent. Analysis of the flood record by the USGS Water Resources Division showed that analyzing the frequency and size of fall floods separately from spring floods—instead of together, as is typically done—gave a more realistic view of how often major floods like those in 1995, 2003, and 2006 might be expected to occur on the Stehekin River (Riedel pers. comm. 2008). Although the length of the record is somewhat limited, floods comparable to these recent large floods might be expected to occur once every 20 years, not once every 100 years, as previously believed (Riedel pers. comm.

**Figure I-6: Stehekin River Large Wood Monitoring 2000 - 2007**

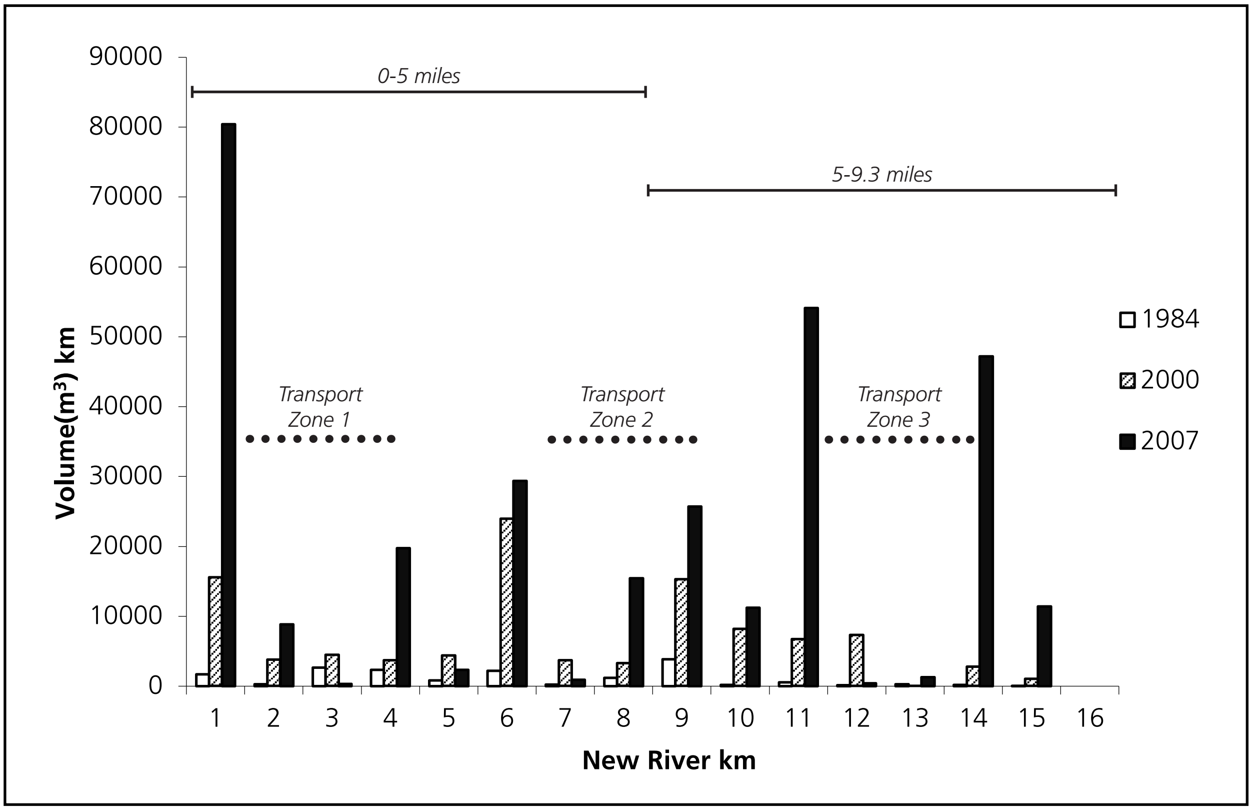
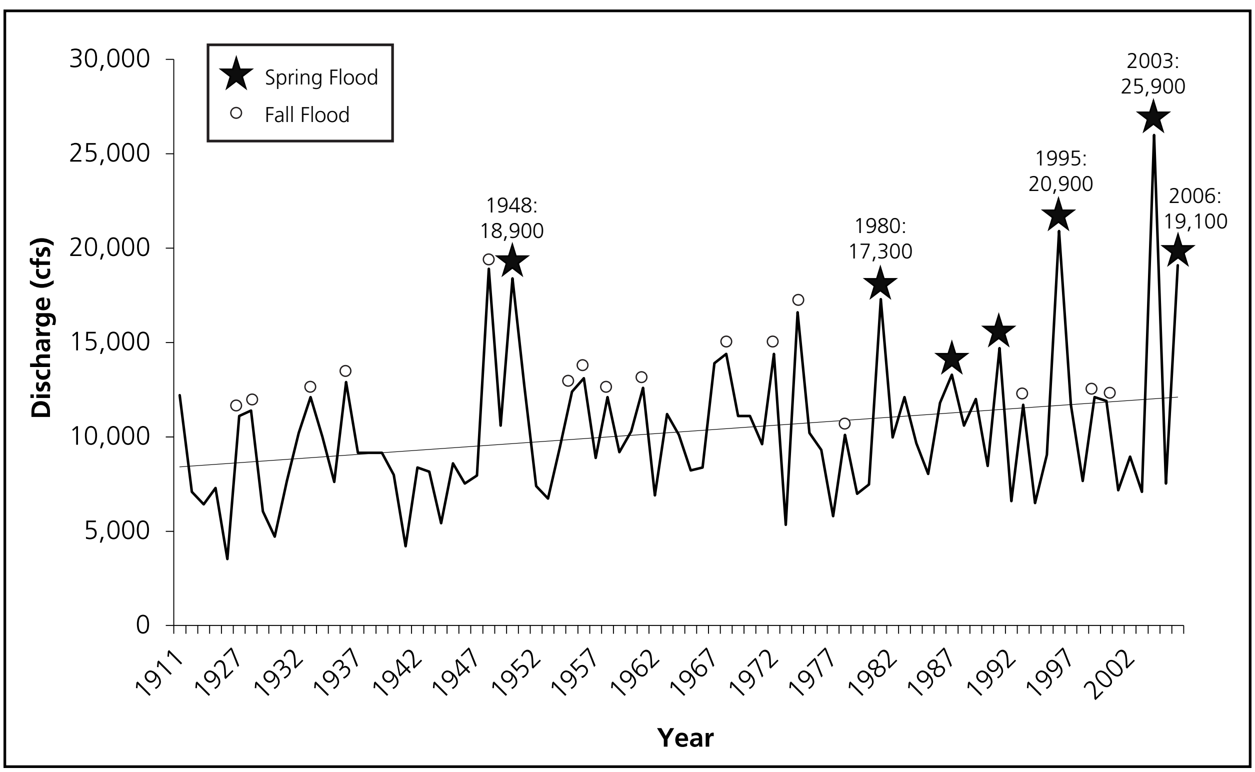



**Figure I-7: Magnitude and Timing of the Annual Peak Flood on the Stehekin River**



2008). When spring and fall flood peaks are looked at separately, it is clear that the high peaks of the fall floods are being obscured by the combination of the spring and fall data, leading to an overall lower prediction of the maximum flood discharge (Table I-2: *Comparison of Two Methods for Estimating Flood Frequency and Magnitude on the Stehekin River*).

Based on analysis of recent flood-related seasonal changes on the Stehekin and other Pacific Northwest rivers, it is likely that the Pacific Northwest will continue to see an increase in the frequency and magnitude of fall flooding related to an increase in winter temperature and increase in eastern Washington rain-on-snow events.

**Table I-2: Comparison of Two Methods for Estimating Flood Frequency and Magnitude on the Stehekin River**

| Recurrence interval (probability in given year)* | Discharge (cfs) for combined fall and spring floods (85 events) | Discharge (cfs) for spring floods alone (70 events) | Discharge (cfs) for fall floods alone (16 events) |
|---|---|---|---|
| 10 - year (0.1) | 14,950 | 13,740 | 21,360 |
| 20 - year (0.04) | 17,560 | 15,100 | 26,220 |
| 50 - year (0.02) | 19,490 | 16,190 | 29,850 |
| 100 - year (0.01) | 21,400 | 17,910 | 33,490 |

**A recurrence interval is used to analyze flood records with mixed fall and spring floods.*

Photo 9 – Stehekin River Mouth after the 2003 flood.

## 4. Human Manipulation of Lake Chelan and the Stehekin River

With the construction of the Lake Chelan Dam in the 1920s, flooding in the lower Stehekin Valley began to be influenced by the level of Lake Chelan. The Chelan PUD showed that the backwater effect of the lake at full pool extends nearly 0.25 mile upstream from the river mouth, effectively raising the 100-year flood event elevation 0.5 foot (Chelan PUD 2000). Within this zone, the backwater effect also likely influences gravel deposition and formation of logjams.

In the years following establishment of Lake Chelan NRA, in response to ongoing bank erosion and threats to private lands and NPS facilities, the NPS and private landowners have reacted to erosion and flooding on the Stehekin River on a case-by-case basis by installing numerous structures. Extensive bank treatments were first placed in the 1960s by the filling of Lake Chelan at Silver Bay and placement of rip-rap at the Stehekin River Resort, as well as the construction of the 400-foot-long crib and levee at upper Company Creek Road in the 1980s. In response to gravel deposition in the channel near McGregor Meadows, the NPS has placed ten rock barbs since 1995 to protect the upper Company Creek Road.

A recent inventory identified 46 sites with bank stabilization measures, including 15 locations with rip-rap, 14 sites with cabled logs (two of these also have rip-rap), and four locations with log-cribbing or logjams. Bank barbs have become the favored approach to bank-erosion problems in the past 15 years due to their effectiveness and relatively low cost. There are now eight sites on the river with a total of 30 bank barbs installed, primarily to protect public roads (Riedel pers. comm. 2008). Most are concentrated in the unstable gravel deposition zone near the McGregor Meadows / Company Creek Road area (13 structures on both sides of the river). Because gravel deposition raises the elevation of the riverbed, bank barbs can become buried and ineffective. Five of the bank barbs installed since 1995 on the Stehekin are hydraulically ineffective less than 15 years after installation. The burial of these bank barbs is not unusual on mountain rivers that carry massive amounts of gravel.

Together, all of the erosion structures affect approximately 8,211 feet (1.56 miles) of Stehekin River shoreline, or approximately 6.5 percent of the river within Lake Chelan NRA.

# C. RELATIONSHIP TO OTHER PLANS

This section includes laws, regulations, executive orders, NPS Policy, and North Cascades NPS Complex planning documents and studies applicable to the SRCIP.

## 1. Laws: Lake Chelan

### Lake Chelan National Recreation Area Enabling Legislation (Public Law 90-544) (selected sections)

(See Appendix 1: *Lake Chelan NRA Enabling Legislation* for the legislation in its entirety). This legislation established the Lake Chelan NRA, identified its key purposes, and provided the basis for land exchanges.

Title III, section 301:

> *Within the boundaries of . . .the recreation areas, the Secretary of the Interior. . .may acquire lands, waters, and interests therein by donation, purchase with donated or appropriated funds, or exchange, except that he may not acquire any such areas within the recreation areas without the consent of the owner, so long as the lands are devoted to uses compatible with the purposes of this Act. Lands owned by the State of Washington or any political subdivision thereof may be acquired only by donation.*
>
> *In exercising his authority to acquire property by exchange, the Secretary may accept title to any non-Federal property within the boundaries of the park and recreation areas and in exchange there for he may convey to the grantor of such property any federally owned property under his jurisdiction in the State of Washington which he classifies as suitable for exchange or other disposal. The values of the properties so exchanged either shall be approximately equal, or if they are not approximately equal the values shall be equalized by the payment of cash to the grantor or to the Secretary as the circumstances require.*

Title IV, section 402 (a):

> *The Secretary shall administer the recreation areas in a manner which in his judgment will best provide for (1) public outdoor recreation benefits; (2) conservation of scenic, scientific, historic and other values contributing to public enjoyment; and (3) such management, utilization, and disposal of renewable natural resources and the continuation of such existing uses and developments as will promote or are compatible with, or do not significantly impair, public recreation and conservation of the scenic, scientific, historic or other values contributing to public enjoyment.*

Appropriations Bill for the Department of the Interior, H.R. 1977, Title I, Section 117 (1996)

See Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

## 2. Laws: National Park Service

### National Park Service Organic Act (1916) [16 U.S. Code (USC) 1]

The Organic Act, which established the NPS and the purpose of national parks, applies to all units of the national park system, including Lake Chelan NRA.

> *The National Park Service shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified. . .by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*

The prohibition against impairment in the Organic Act has been described in *Management Policies* (NPS 2006) and *Director's Order-12, Conservation Planning, Environmental Impact*

*Analysis, and Decision-making*. The park manager's determination of non-impairment for the selected alternative will be provided as an attachment to the Record of Decision.

See also Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

### 1970 National Park Service General Authorities Act (as amended) (Public Laws 91-368, 94-458, and 95-250—the Redwood Act) (16 USC 1a et seq.)

This act prohibits the NPS from allowing any activities that would cause derogation of the values and purposes for which the parks have been established (except as directly and specifically provided for by Congress in the enabling legislation for the parks). Therefore, all units are to be managed as national parks, based on their enabling legislation and without regard for their individual titles. Parks also adhere to other applicable federal laws and regulations, such as the Endangered Species Act (ESA), the Clean Water Act (CWA), the NHPA, the Wilderness Act, and the Wild and Scenic Rivers Act. To articulate its responsibilities under these laws and regulations, the NPS has established management policies for all units under its stewardship (see "7. National Park Service Policies" and Appendix 15: *Laws, Regulations, and Policies Whitepaper*).

## 3. Other Federal Laws

### National Environmental Policy Act (Public Law 91-190) (42 USC 4341 et seq.)

NEPA requires the identification, documentation, and public disclosure of the environmental consequences of federal actions. Section 102 of the act requires that "in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment, there be a detailed statement concerning the environmental impact of a proposed action." Regulations implementing NEPA are set for by the President's Council on Environmental Quality (CEQ) (40 CFR Parts 1500 - 1508). CEQ regulations establish the requirements and process for agencies to fulfill their obligations under the act.

NEPA sets up a procedural requirement for the preparation of environmental impact statements. An EIS requires public involvement throughout the decision-making process. In an EIS, the impacts of the proposed action and the alternatives to the proposed action are clearly presented to enable a clear basis for choice from among the options by the decision maker and the public.

The NPS has adopted specific procedures for analyzing environmental impacts and complying with NEPA (*Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making* [NPS 2001a]). See also Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

### Clean Water Act (Public Laws 92-500 and 95-217) (33 USC 1241 et seq.)

See Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

## Clean Air Act (as amended) (Public Law 88-206) (42 USC 7401 et seq.)

The Clean Air Act (CAA) states that park managers have an affirmative responsibility to protect park air quality and air quality-related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse air pollution impacts. Special visibility-protection provisions of the CAA also apply to class I areas, including new national rules to prevent and remedy regional haze affecting these areas. Under existing visibility-protection regulations, the NPS has identified "integral vistas" that are important to the visitor's visual experience in many NPS class I areas, and it is NPS policy to protect these scenic views. North Cascades National Park is a class I area and Lake Chelan NRA is a class II area under the CAA.

## Endangered Species Act (Public Law 93-205) (16 USC 1531 et seq.)

See Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

## National Historic Preservation Act (1966 as amended) (Public Laws 89-665 and 95-515) (16 USC 470)

The purpose of the NHPA is to preserve, conserve, and encourage the continuation of the diverse traditional prehistoric, historic, ethnic, and folk cultural traditions that underlie and are a living expression of American heritage. The act directs federal agencies to inventory historic properties (Section 110) and to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties (Section 106). Historic property is any district, building, structure, site, or object that is eligible for listing in the National Register of Historic Places because the property is significant at the national, state, or local level in American history, architecture, archeology, engineering, or culture. Requirements for implementing Section 106 are found in the Code of Federal Regulations (36 CFR Part 800).

## Archaeological Resources Protection Act of 1979 (ARPA) (Public Law 96-95) (16 USC 470aa)

This act provides a means for additional protection of archeological resources and for prosecuting the collecting of resources on federal lands. Its purpose is to secure, for the present and future benefit of the American people, the protection of archeological resources and sites that are on public lands and Indian lands (NPS 2006: 5.3.5.3).

## Wild and Scenic Rivers Act (1968) (Public Law 90-542) (16 USC 1271 - 1287)

See Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

### Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended) (Public Law 91-646) (42 USC 4601 et seq.)

This law mandates offering "just compensation" for real property based on a Fair Market Value appraisal, and sets criteria for appraisals. The law also mandates certain land acquisition and relocation benefits, like moving reimbursement, to eligible parties involved with a federal realty acquisition.

### Federal Land Exchange Facilitation Act of 1988 (Public Law 100-409) (43 USC 1701)

This act sets up a process to "facilitate and expedite land exchanges pursuant to the Federal Land Policy and Management Act of 1976 and other applicable laws for the Departments of the Interior and Agriculture by (a) providing more uniform rules and regulations pertaining to land appraisals which reflect nationally recognized appraisal standards; and (b) establishing procedures and guidelines for the resolution of appraisal disputes." It also sets up the means "to provide sufficient resources to the Secretaries of the Interior and Agriculture to ensure that land exchange activities can proceed consistent with the public interest" and requires a "study and report concerning improvements in the handling of certain information related to federal and other lands."

### Land and Water Conservation Fund Act of 1965, as amended (Public Law 88-578) (16 USC 460l et seq.)

This act provides funds for and authorizes federal assistance to the states in planning, acquisition, and development of needed land and water areas and facilities and provides funds for the federal acquisition and development of certain lands and other areas. The amendments (July 15, 1968) provide that the values of the properties shall be approximately equal or may be equalized in part by cash.

## 4. Federal Regulations

Federal regulations applicable to land use and development in Lake Chelan NRA include but are not limited to the following: Minerals Management (36 CFR 9) and Rights-of-Way (36 CFR 14).

### 36 CFR Part 17

This regulation provides the means to identify lands "suitable for disposal" and determines the range of acceptable uses (typically for single-family residential and related outbuildings), with associated deed restrictions and/or protective easement criteria that can be applied to lands in the identified special-use zones. Similar to the Part 18 requirement for a "high-bid" auction, Part 17 requires a similar Fair Market Value appraisal and competitive bidding process. In Part 17, however, the landowner has a right of preference to match the high bidder if the lands are offered for disposal within two years following acquisition. To use this authority in Stehekin, the seller (exchange proponent) is offered the preference via the exchange to take other park land (not public domain lands) in lieu of a cash payment from the NPS for their "offered" lands.

### 36 CFR Part 18: Leasing of Properties in Park Areas

This regulation contains the how-to, step-by-step process for doing NPS land exchanges as generally alluded to in *Director's Order 25: Land Acquisition* (NPS 2001b). It only applies specifically, however, to exchange of historic properties under the NHPA.

When combined with the North Cascades National Park, Lake Chelan NRA, and Ross Lake NRA legislation (Section 302), these regulations provide the practical authority to use 36 CFR Parts 17 and 18 and other applicable authorities for the Secretary to acquire lands within the complex and to exchange lands within Lake Chelan NRA (Stehekin). This legislation is applicable and provides a unique authority outside the more generic references in the Land and Water Conservation Fund Act and in NPS *Director's Order 25* (NPS 2001b).

### 36 CFR Part 800: Advisory Council Regulations

This regulation implements Section 106 of the National Historic Preservation Act.

### 40 CFR Part 1500 - 1508: NEPA Regulations

This regulation implements the National Environmental Policy Act.

## 5. Legal Actions

United States v. Chelan County CS-92-331-AMM (E.D. Wash.)

This ruling quieted title to Stehekin Valley Road in the name of the United States against Chelan County, and permanently enjoins Chelan County from interfering with the NPS's administration and management of Stehekin Valley Road (NPS NOCA 1993a).

## 6. Executive Orders

The following executive orders are among those applicable to land management in the Stehekin Valley.

### Floodplain Management Executive Order 11988 (1977, 42 CFR 26951, PL 93-234 Section I) (as amended by Executive Order 12148, 1979, 44 FR 43239, 42 USC 4321)

See Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

### Protection of Wetlands Executive Order 11990 (1977, 42 FR 26961) (as amended by Executive Order 12608, 1987, 52 FR 34617, 42 USC 4321)

See Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

## Invasive Species Executive Order 13112 (1999, 64 FR 6183) (as amended by Executive Order 13286, 2003, 68 FR 10619, 42 USC 4321)

This executive order was crafted "to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause." It requires federal agencies whose actions may affect invasive species to identify their actions, and to use relevant programs and authorities to:

- prevent the introduction of invasive species;
- detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner;
- monitor invasive species populations accurately and reliably;
- provide for restoration of native species and habitat conditions in ecosystems that have been invaded;
- conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control . . . ; and
- promote public education on invasive species and the means to address them.

It also states that federal agencies may not authorize, fund, or carry out actions that will cause or promote the introduction and spread of species unless the agency believes that the benefits of such actions clearly outweigh the harm and has taken all feasible and prudent measures to minimize the risk of harm in conjunction with such actions.

Photo 10 – Stehekin River near Buckner Homestead Hayfield and Pasture during a fall flood (Jon Riedel).

### Facilitation of Cooperative Conservation Executive Order 13352 (2004, 69 FR 52989, 42 USC 4332)

The purpose of this executive order is "to ensure that the Departments of the Interior, Agriculture, Commerce, and Defense and the Environmental Protection Agency implement laws relating to the environment and natural resources in a manner that promotes cooperative conservation, with an emphasis on appropriate inclusion of local participation in federal decision making, in accordance with their respective agency missions, policies, and regulations." In doing so, federal agencies are directed to "carry out the programs, projects, and activities of the agency that they respectively head that implement laws relating to the environment and natural resources in a manner that: facilitates cooperative conservation; takes appropriate account of and respects the interests of persons with ownership or other legally recognized interests in land and other natural resources; properly accommodates local participation in federal decision-making; and provides that the programs, projects, and activities are consistent with protecting public health and safety."

## 7. National Park Service Policies

### NPS Management Policies 2006

*Management Policies 2006* (NPS 2006a) governs the way park managers make decisions on a wide range of issues that come before them. Excerpts from several sections applicable to this SRCIP / FEIS are highlighted below.

#### *Section 1.4.3 The NPS Obligation to Conserve and Provide for Enjoyment of Park Resources and Values*

> *The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. This mandate is independent of the separate prohibition on impairment and applies all the time with respect to all park resources and values, even when there is no risk that any park resources or values may be impaired. NPS managers must always seek ways to avoid, or to minimize to the greatest extent practicable, adverse impacts on park resources and values. The laws do give the Service the management discretion, however, to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, so long as the impact does not constitute impairment of the affected resources and values.*
>
> *The fundamental purpose of all parks also includes providing for the enjoyment of park resources and values by the people of the United States. The enjoyment that is contemplated by the statute is broad; it is the enjoyment of all the people of the United States and includes enjoyment both by people who visit parks and by those who appreciate them from afar. It also includes deriving benefit (including scientific knowledge) and inspiration from parks, as well as other forms of enjoyment and inspiration. Congress, recognizing that the enjoyment by future generations of the national parks can be ensured only if the superb quality of park resources and values is left unimpaired, has provided that when there is a conflict between conserving*

*resources and values and providing for enjoyment of them, conservation is to be predominant. This is how courts have consistently interpreted the Organic Act.*

### *Section 1.4.4 The Prohibition on Impairment of Park Resources and Values*

*While Congress has given the Service the management discretion to allow impacts within parks, that discretion is limited by the statutory requirement (generally enforceable by the federal courts) that the Park Service must leave park resources and values unimpaired unless a particular law directly and specifically provides otherwise. This, the cornerstone of the Organic Act, establishes the primary responsibility of the NPS. It ensures that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunities for enjoyment of them.*

*The impairment of park resources and values may not be allowed by the Service unless directly and specifically provided for by legislation or by the proclamation establishing the park. The relevant legislation or proclamation must provide explicitly (not by implication or inference) for the activity, in terms that keep the Service from having the authority to manage the activity so as to avoid the impairment.*

### *Section 1.4.5 What Constitutes Impairment of Park Resources and Values*

*The impairment that is prohibited by the Organic Act and the General Authorities Act is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.*

*An impact to any park resource or value may, but does not necessarily, constitute an impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is*

- *necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or*
- *key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or*
- *identified in the park's GMP or other relevant NPS planning documents as being of significance.*

*An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to preserve or restore the integrity of park resources or values and it cannot be further mitigated. An impact that may, but would not necessarily, lead to impairment may result from visitor activities; NPS administrative activities; or activities undertaken by concessioners, contractors, and others operating in the park. Impairment may also result from sources or activities outside the park. . .*

### *Section 1.4.6 What Constitutes Park Resources and Values*

> *The "park resources and values" that are subject to the no-impairment standard include: the park's scenery, natural and historic objects, and wildlife, and the processes and conditions that sustain them, including, to the extent present in the park: the ecological, biological, and physical processes that created the park and continue to act upon it; scenic features; natural visibility, both in daytime and at night; natural landscapes; natural soundscapes and smells; water and air resources; soils; geological resources; paleontological resources; archeological resources; cultural landscapes; ethnographic resources; historic and prehistoric sites, structures, and objects; museum collections; and native plants and animals; appropriate opportunities to experience enjoyment of the above resources, to the extent that can be done without impairing them; the park's role in contributing to the national dignity, the high public value and integrity, and the superlative environmental quality of the national park system, and the benefit and inspiration provided to the American people by the national park system; and any additional attributes encompassed by the specific values and purposes for which the park was established.*

### *Section 1.4.7 Decision-making Requirements to Identify and Avoid Impairments*

> *Before approving a proposed action that could lead to an impairment of park resources and values, an NPS decision-maker must consider the impacts of the proposed action and determine, in writing, that the activity will not lead to an impairment of park resources and values. If there would be an impairment, the action must not be approved.*

### *Section 3.3, Land Protection Plans*

> *…Land Protection Plans (LPPs) should be prepared to determine and publicly document what lands or interests in land need to be in public ownership and what means of protection area available to achieve the purposes for which the unit was created…*
>
> *Land acquisition priorities will be guided by a park unit's land protection plan. Superintendents will ensure that land protection plans are developed, and periodically reviewed and updated to identify what land or interests in land would facilitate achieving desired park purposes…*

### *Section 4.3.4, National Wild and Scenic Rivers System*

> *…No management actions may be taken that could adversely affect the values that qualify a river for inclusion in the National Wild and Scenic Rivers System.*

### *Section 4.6.4, Floodplains*

See Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

### *Section 4.6.6, Watershed and Stream Processes*

See Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

### *Section 9.2.1.1, Park Roads*

> *Park roads will be well constructed, sensitive to natural and cultural resources, reflect the highest principles of park design, and enhance the visitor experience. Park roads are generally not intended to provide fast and convenient transportation; rather, they are intended to enhance the quality of a visit while providing for safe and efficient travel with minimal or no impacts on natural and cultural resources. For most parks, a road system is already in place. When plans for meeting the transportation needs of these parks are updated, a determination must be made as to whether the road system should be maintained as is, reduced, expanded, reoriented, eliminated, or supplemented by other means of travel. Before roads are chronically at or near capacity the use of alternative designation points or transportation systems or limitations on use will be considered as alternatives to road expansion.*
>
> *Park road designs are subject to NPS Park Road Standards, which are adaptable to each park's unique character and resource limitations. Although some existing roads do not meet current engineering standards, they may be important cultural resources whose values can and should be preserved with attention to visitor safety.*

### *Section 9.4.4, Maintenance Structures*

> *Maintenance structures will be consistent in design, scale, texture, and details with other park facilities. Optimally, they will be screened or located in areas remote from public use…*

## Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making

This order identifies the standards to which NPS environmental analysis documents, including categorical exclusions, environmental assessments (EAs), and EISs, must comply. It contains a list of applicable Departmental (Interior) and agency (NPS) categorical exclusions.

## Director's Order 25: Land Protection

This order articulates the framework for land protection and the process for the acquisition of land and interests in land within the authorized boundaries of units of the NPS. It summarizes applicable information from *Management Policies 2006* (NPS 2006a) and sets forth other requirements and responsibilities as they relate to the NPS's land protection program.

## Director's Order 87A: Park Roads and Parkways

> *The fundamental purpose of national parks …dictates that the quality of the park experience must be our primary concern. Full enjoyment of a national park visit depends on its being a safe and leisurely experience. The distinctive character of park roads plays a basic role in setting this essential unhurried pace. Consequently, park roads are designed with extreme care and sensitivity with respect to the terrain and environment through which they pass—they are laid lightly onto the land (p. 7).*

*Each segment of every park road should relate to the resource it traverses in a meaningful way and should constitute an enjoyable and informative experience in itself while providing the visitor the utmost in visual quality…The horizontal and vertical alignment and cross-section should respect the terrain, blending into the environs…The purpose of park roads remains in sharp contrast to that of the federal and state highway systems. Park roads are not intended to provide fast and convenient transportation; they are intended to enhance visitor experience while providing safe and efficient accommodation of park visitors and to serve essential management access needs (p. 7).*

*Park roads are constructed only where necessary, and only as necessary to provide access for the protection, use and enjoyment of the natural, historical, cultural and recreational resources which constitute our National Park System. National park roadways, where they exist, are planned for leisurely sightseeing and are located with sensitive care for the environment and designed with extreme care. They are often narrow, winding, and hilly—but therein may lie their appeal… (p. 13).*

*Thus park roads are often an end in themselves, rather than just a means to an end, in contrast to more conventional highway systems. For some, such as the handicapped, roads may provide the only means of park use, thereby reinforcing the case for their being intimately blended with the resource. Where terrain and safety conditions permit and where such uses are advocated by the general management plan, opportunities should be provided for random stopping to enable park visitors to more completely experience the park resources (p. 13).*

## 8. North Cascades National Park Service Complex Plans

### Lake Chelan National Recreation Area Executive Summary, Final General Management Plan / Environmental Impact Statement

The final GMP executive summary (NPS LACH 1995c) identifies the key features and actions associated with the selected alternative in the GMP. Because it is derived from the GMP, it contains the vision for Lake Chelan NRA:

*The rustic setting of Lake Chelan (LACH) would be part of a transition from the down lake recreational, residential, agricultural, and industrial setting to the very wild and natural North Cascades National Park. The use of LACH resources by visitors and residents would be limited to preserve the natural, scenic, and cultural values of the area. (NPS LACH 1995c: 5).*

### Lake Chelan National Recreation Area Final General Management Plan / Environmental Impact Statement

The final GMP (NPS LACH 1995a) provides some additional detail about the management objectives and corresponding actions that would be undertaken in Stehekin. This plan identifies the following management objectives associated with the management of Lake Chelan that would be implemented or clarified by the SRCIP.

### *Natural Resource Management*

The NPS would:

- manage Lake Chelan NRA as an integral part of a larger regional ecosystem and protect and restore the components and processes of naturally evolving park ecosystems, including the natural abundance, biodiversity, and ecological integrity of plants, animals, water, and soil to the extent public safety considerations permit (NPS LACH 1995a:19).
- not manipulate the Stehekin River to protect federal property except that it would protect roads in erosion / river conflict zones [if certain criteria were met] (NPS LACH 1995a:20).
- not manipulate the river to protect private property [but would also not take action] to prevent private owners from manipulating the river on their land to protect their property unless [they] would significantly harm recreation area resources or were in violation of local, state, or federal ordinances, regulations, or laws (NPS LACH 1995a:20).
- manipulate woody debris in the Stehekin River or its tributaries only to protect public roads and bridges according to the criteria above (NPS LACH 1995a:21).
- work with the county to encourage private property owners to protect natural river processes…. The highest priority would be placed on acquiring lands through exchange or purchase, that are threatened by or where development threatened natural river processes (NPS LACH 1995a:21).
- [encourage property owners] to minimize impacts on wetland, floodplain, shoreline or riparian areas (NPS LACH 1995a:21).
- [relocate] NPS structures that could be threatened by river processes (NPS LACH 1995a:23).
- [bring campgrounds in regulatory floodplains] into compliance with floodplain guidelines (NPS LACH 1995a:23).
- [encourage property owners] to minimize impacts on wetland, floodplain, shoreline, or riparian areas. The NPS would take appropriate measures where actions threatened to cause significant impacts on wetland, floodplain, shoreline, or riparian areas (NPS LACH 1995a:23).
- restrict mining to the Company Creek borrow pit for NPS maintenance and public use and minor reconstruction only; [and] allow for importing of material from outside the valley for new construction (NPS LACH 1995a:23).
- [conserve and recycle sand, rock, and gravel] whenever possible (e.g., consider conservation through maintenance and road system design. No sand, rock, or gravel would be removed from the 100-year floodplain of the Stehekin River or its tributaries (NPS LACH 1995a:24).
- [restore the] natural character of the lake and river edge on public lands, [including] areas within 200 feet of the lake and river shoreline (NPS LACH 1995a:27).

### *Visitor Experience*

The NPS would:

- [pave the Stehekin Valley Road] from the Landing to 9-mile (NPS LACH 1995a:30).

- [manage the Stehekin River] as a dynamic natural system.... Opportunities for visitors to appreciate the power and intricacy of the river as a natural system would be enhanced (NPS LACH 1995a:30).

### *Land Use and Development*

The NPS would:

- Provide transportation and access to, from, and within the NRA to accomplish a quality visitor experience, fulfill resource management objectives, and meet local Stehekin Community needs (NPS LACH 1995a:32 - 33).
- [maintain] the current character (slow leisurely pace) and surface (chipseal) of the main valley road from [the] Landing to Harlequin Bridge (NPS LACH 1995a:33).
- [pave and reduce] to a single-lane (12 - 14 feet wide) with pullouts that would be visible from both directions (18 feet wide; 30 - 35 feet long) [the road between Harlequin Bridge and 9-mile] (NPS LACH 1995a:33).
- [maintain] Company Creek Road ... in its current alignment and condition (NPS LACH 1995a:34).
- [develop] an 11-mile pedestrian and horseback trail ... from the Landing to High Bridge; sensitive areas would be avoided to minimize impacts. It would be marked and maintained as a cross-country ski route as well. A pedestrian and horseback riding trail system that connects key lower valley features to the Stehekin Valley Road would also be developed (NPS LACH 1995a:34).
- [improve Weaver Point dock facilities] to accommodate the Purple Point dock and allow seasonal moving of the dock between Purple Point and Weaver Point (NPS LACH 1995a:34).
- [retain all NPS campgrounds] (NPS LACH 1995a:39).
- [consolidate some NPS and concession housing] in clustered sites beside the airstrip, based on environmental parameters and in compliance with compatibility criteria (NPS LACH 1995a:39).
- [relocate NPS vehicle fuel storage / dispensing to the airstrip] (NPS LACH 1995a:39).
- [locate maintenance facilities near the airstrip] (NPS LACH 1995a:40).

### *Park Operations*

The NPS would:

- provide road maintenance for all designated public roads including the Stehekin Valley Road ... (including snow removal nine miles upvalley) (NPS LACH 1995a:48).
- strengthen working relationships with others, defining shared objectives and developing strategies that lead to cooperative agreements for the management of natural, scenic, cultural, and recreational resources (NPS LACH 1995a:48).

See also Appendix 2: *Management Objectives and Actions in the Lake Chelan NRA GMP Applicable to the SRCIP* and Appendix 15: *Laws, Regulations, and Policies Whitepaper* for more information on the GMP.

## Lake Chelan National Recreation Area Land Protection Plan

This plan (NPS LACH 1995b) would be revised as part of Alternatives 2, 3, 4, and 5 in this document.

The LPP's purpose is to:

- Effectively respond to private property owners who willingly and voluntarily approach the NPS with the goal of exchanging or selling their land.
- Provide a basis for meaningful and constructive NPS review of proposals for land use change on private land within the Stehekin Valley to ensure that new or modified land use and development is compatible with the purposes of Lake Chelan NRA and/or consistent with sustainable practices within the Stehekin River channel migration zone.
- Fulfill federal policy requirements to have a plan that makes use of the full range of land protection authorities to augment the land protection measures provided by Chelan County and Washington state land use laws, regulations and policies.
- Use land protection strategies such as easement, exchange, or acquisition to relocate or remove threatened development from the Stehekin River channel migration zone and/or encourage residents to implement advanced protection measures and ensure that structures and developments within the valley are sustainable.

The 2012 revised draft Lake Chelan LPP includes eight management objectives to meet the overall goal to ensure that land uses on public and private lands are compatible with the purpose of the park and ten guidelines that form the basis for implementing the plan.

The LPP also identifies compatibility criteria that assist in determining how uses contribute to or detract from the purposes of Lake Chelan NRA. The compatibility criteria were first identified in 1988, and then updated in 1992 and in 1995. Five purposes guide the application of the compatibility criteria in the revised plan:

- To identify uses that would harm, degrade, or adversely affect resource values of Lake Chelan NRA.
- To identify proposed types and levels of land uses that would harm resources when cumulative effects are considered in the context of previously established uses.
- To encourage uses that would enhance resource values and the general character of the valley.
- To encourage conversion from a higher-impact land use to a lower-impact land use (NPS LACH 1995b:12 - 13).
- To provide certainty to property owners about what is compatible and what is not compatible use.

Residents may ask the Complex superintendent for a compatibility determination and should receive a letter within 45 days, subject to a 30-day extension for more information, if needed.

Land use protection techniques detailed in the LPP include agreements (cooperative and overlay district), regulations, and various methods of acquisition (fee, easement, donation, exchange, purchase, purchase and sellback, reservation of life or term estates, and condemnation). Priorities (high, medium, and low) are also established.

## Lake Chelan National Recreation Area Stehekin Landing and Valley Development Concept Plan

These combined plans (NPS LACH 1995d) prescribe NPS development plans for the Stehekin Landing, Stehekin Valley (roads, trails, and transportation services), and the Airstrip area.

## Sand, Rock, and Gravel Plan

This plan (NPS LACH 1995e) stipulated that no sand, rock, or gravel would be removed from the 100-year floodplain of the Stehekin River or its tributaries and that material needed for construction would be barged in. Guidelines include the following:

> *Allow mining of sand, rock and gravel in Stehekin Valley but restrict mining to the Company Creek borrow pit for NPS maintenance and public use and minor reconstruction only; allow for importing of material from outside the valley for new construction. (NPS LACH 1995a:23)*
>
> *Sand, rock and gravel will be conserved and recycled whenever possible (e.g., consider conservation through maintenance and road system design). (NPS LACH 1995a:24)*
>
> *To ensure conservation of sand, rock and gravel, the National Park Service proposes to limit the use of in-park material to 1,400 cubic yards per year: 1,200 cubic yards for NPS use and 200 cubic yards per year for private use over a proposed 10-year excavation cycle—i.e., in the event of a large flood, the remaining 10-year stockpile could be used in one year… The superintendent will have the option to exceed the established limit in the event of an emergency such as a major flood. (NPS LACH 1995e:10 - 11).*

The plan projected that the paving of the Stehekin Road from Harlequin Bridge to Milepost 9.0 would reduce gravel use, but anticipated that road repairs would continue to be required following flood events. It did not address specific projects, such as relocating the road farther away from the river. It does specify when and for what purposes material from the local Company Creek Pit in Stehekin may be used (NPS LACH 2005a:7).

The *Sand, Rock, and Gravel Plan* is related to the current proposed project because some material from the local Company Creek Pit would be used for certain aspects of the project. Because the proposal in the SRCIP would need to comply with the plan, material from this source could only be used in certain instances, such as to repair flood-damaged road sections. In the SRCIP, material that has been determined to be excess to Lake Chelan NRA needs (oversize material and some screened material) could also be used. Much of the earth-related material needed for the current project, however, would come from road reroutes or would be barged in from an outside source (NPS LACH 2005a:7).

## Lake Chelan National Recreation Area Transportation Plan

**Campgrounds:** All campgrounds will be retained. Weaver Point Campground will be expanded and some sites will be moved back from the shoreline. Campsites will be low density, unobtrusive and safe, with ample screening. Water will be provided and all sites will have access to pit or composting toilets. Campsites will be removed from hazardous areas as necessary. (NPS LACH 1995f:2)

**Stehekin Valley Road:** The transportation plan repeats the language in the GMP regarding the Stehekin Valley Road (see “Land Use and Development” section above).

**Company Creek Road:** Company Creek Road will be maintained in its current alignment and condition. Erosion control systems along the upper Company Creek Road will be removed and replaced, designed to keep the road from eroding during frequently recurring flood events (i.e., 10- to 25-year recurrence interval), and will be made from rock, soil, and native vegetation . . .

Public roads below Cottonwood will be protected in active river erosion zones only if (1) there are no feasible alternatives, (2) funds are available, (3) the actions will have less impacts than other alternatives, and (4) the actions are permitted by county, state, and other federal agencies. No new road construction will be permitted in active river conflict zones. (NPS LACH 1995f:9)

**Trails:** The Transportation Plan repeats the GMP language (see above) and adds the following:

Some old and abandoned road alignments may be converted to new trail loops in the lower valley. (NPS LACH 1995f:9 - 10)

One new trail system, from the Castle area to the river trail, will be developed, including a suspension bridge just below the confluence of Boulder Creek. (The existing river trail connects the Weaver Point and Harlequin Bridge areas). (NPS LACH 1995f:10)

The use of bicycles on roads will be encouraged, but bicycles will not be allowed on pedestrian trails except on connections to features and in some campgrounds. (NPS LACH 1995f:10).

**Maintenance Facility:** A new maintenance facility will be constructed near the airstrip, including shuttle bus storage and maintenance, equipment, a repair building, a search and rescue fire cache, and a helicopter pad. Hazardous material, propane, and gasoline storage and NPS vehicle fuel storage and dispensing will also be relocated to the airstrip area in a safe area outside the 500-year floodplain. The future use or removal of the existing maintenance facility has yet to be determined; however, any use would be compatible with floodplain management guidelines. (NPS LACH 1995f:13)

## Lake Chelan National Recreation Area Forest Fuel Reduction Plan / Firewood Management Plan

The *Forest Fuel Reduction Plan* (NPS 1995g) was developed and is being implemented to reduce forest fuel accumulation in selected coniferous stands in the Stehekin Valley. The goals are to protect the safety of human life and property in the valley, to protect natural and cultural resources, to restore the forest to a late successional stage, and to protect old growth forest, particularly ponderosa pine. The plan provides for selective thinning and use of management-ignited controlled fires to reduce the fuel supply and risk of wildfires. It specifies the disposition of firewood obtained from tree thinning and also provides for long-term monitoring of the program to evaluate management actions (NPS 2005e:7).

The Stehekin Valley Road is the main route that would be used by visitors or residents to exit the Lake Chelan NRA in the event of a wildfire. Maintenance of the road is an important part of the strategy to protect Lake Chelan NRA users and local citizens from wildfire and structural fires. This is also the route that would be used to bring in equipment and personnel to fight wildfires in this area. Thus, protection of the road from wildfire is an important part of the strategy to protect resources and personal property in this area. As part of the fuel management program, management-prescribed and controlled fires are set and thinning of the forest is used to reduce fuels in the valley and to maintain a healthy late successional forest. NPS also conducts wildfire-suppression activities through its forest fuel reduction program (NPS LACH 1995a).

## 9. Company Creek Road Environmental Assessments 1989 - 2007

See Appendix 5: *Cumulative Impacts Project List*.

## 10. Stehekin Valley Road Environmental Assessments 1993 - 2007

See Appendix 5: *Cumulative Impacts Project List*.

The following actions were implemented as noted:

- (2006) Milepost 7.0: A permanent reroute of approximately 1,000 feet (0.19 mile) following emergency reroute (constructed after October 2003) moved the road farther away from the river. Revegetation was also completed from Milepost 7.0 to 7.5.
- (2006) Milepost 7.5: Reroute road farther from Stehekin River (2,300 feet or 0.44 mile).
- (2007) Milepost 8.0: Repair and reinforce existing stream bank revetment; install four new barbs downstream of two existing barbs.
- (2005) WeavTel
- (2003) Courtney-Keller Park Land Exchange
- (2003) Griffith Cabin Housing Replacement

### Stehekin Valley Road Improvement Project Environmental Assessment

This EA included actions on five miles of the road from Harlequin Bridge to below High Bridge, including paving, reroutes (1,100 feet and 2,200 feet in length), raising of the road surface, and drainage improvements at specific locations, including repair of culverts, installation of bank protection, and installation of new barbs.

There are some measures that have not yet been implemented from the selected action in the *Stehekin Valley Road Implementation Project Environmental Assessment* (NPS LACH 2005a) that would be included in all alternatives in the SRCIP. Implementation of some portions of the Road Improvement Project EA were put on hold because immediately following the preparation of the EA, a second 100-year flood occurred on the Stehekin River in 2006 and it became clear to NPS and FHWA staff that surfacing, rehabilitation and raising sections of the Stehekin Valley Road were not going to be enough to prevent future damage to the roadway. As a result, the NPS began implementation of some actions from the EA but postponed implementation of others to undertake a more comprehensive analysis of the Stehekin River corridor to determine what actions would best protect public facilities and allow continued access to private property with respect to the apparent flood regime changes on the Stehekin River.

Those measures that have not yet been implemented from the selected action in the Stehekin Valley Road Improvement Project Environmental Assessment and FONSI (NPS LACH 2005a) would either be included in all alternatives or have been modified in the action alternatives based on new information and are explained below. Impacts of these modified actions are the same as were described in that EA/FONSI.

These measures include rehabilitation of the road from Harlequin Bridge to Milepost 9.2, surfacing of the road, installing erosion protection measures at Milepost 5.3 (Wilson Creek), and construction of new pullouts and a winter turnaround / parking area. Because of the proposed reroutes, other measures from that EA, such as the grade raise in McGregor Meadows, would only be implemented as part of Alternative 1 or 4 (see "Description of Alternatives 1 - 5" for each alternative discussed in Chapter II: *Management Alternatives*).

## 11. Other Related Environmental Assessments

### Finding of No Significant Impact: Acquisition of Interest in Private Land in the Stehekin Valley Environmental Assessment

Under this EA/ Finding of No Significant Impact (FONSI) (NPS LACH 2003a), the NPS acquired 5.0 acres of private land (Tract 04-103) near the head of Lake Chelan to protect high resource values and exchanged 7.15 acres of federal land (Little Boulder/Boulder creeks) (Tract 05-131) previously identified in the 1995 LPP (NPS LACH 1995b) as potentially available for exchange. This action was undertaken to provide protection of river dynamics and natural processes within the floodplain of the Stehekin River.

## 12. North Cascades National Park Service Complex Studies

**Stehekin River Floodplain Mapping:** In 1993, the NPS updated and corrected the 1981 FEMA floodplain map by adding 14 cross sections upstream, recalculating Manning's roughness values, and by using a more accurate base map (NPS NOCA1993b). This map was not adopted by Chelan County/FEMA, but was used in development of the 1995 GMP (NPS LACH 1995a) and other actions.

**Large Woody Debris:** In the 1980s, the NPS commissioned a study of large wood accumulations that resulted in a report by Mason and Koon (1985). Following up on this study, NPS repeated large wood inventories in 2000 and 2007.

**Stehekin River Inventory Report:** In 2004, NPS published a technical report on the results of several inventory and monitoring programs on the Stehekin River (NPS LACH 2004b).

**Sediment Yield:** A study by NPS and Chelan PUD in 2001 compared 1978 and 2000 Chelan PUD surveys at the river mouth to assess vertical changes in the Stehekin River bed (Chelan PUD

2001a). The NPS estimated annual sediment yield at 25,000 cubic yards per year, with about 17 percent, or 5,600 cubic yards, of that contained in bed load.

**Backwater Effect of Lake Chelan:** Chelan PUD studied the effect of the manipulated level of Lake Chelan on flooding and backwater in the lower Stehekin River (Chelan PUD 2001b). The study was based on a one-dimensional hydraulic model, and indicated that a backwater effect extends at least 0.25 mile up the river from the lake and increases the 100-year flood elevation by approximately 0.5 feet.

**Flood Frequency Analysis:** In 2008, the USGS reanalyzed the flood data for the Stehekin River to update analyses used in the 1997 Company Creek EA. The analysis was revisited using the flood data from large events in 2003 and 2006, and a new approach that separated spring and fall flood events for statistical analysis of magnitude and frequency. As a result, this analysis provided a return interval of 20 years for the 26,000 cfs flood, in contrast to the 100-year return interval used in the 1981 FEMA study.

**Information Summaries:** In addition to these studies, there were two "white papers" prepared to summarize the status of information on various resources for the SRCIP: Laws, Regulations, and Policies (Zipp 2008; see Appendix 15) and Current Knowledge Base (Riedel 2009; see Appendix 16).

## 13. Other Applicable Ordinances and Plans

### State of Washington

#### *Washington State Department of Fish and Wildlife*

Washington State Hydraulic Code: see Appendix 15: *Laws, Regulations, and Policies Whitepaper*.

### Chelan County

#### *Chelan County Comprehensive Plan*

Under Chelan County zoning regulations, the Stehekin Valley is in a general-use zone, where single-family residential is the primary use. Property owners, however, can petition the county for a conditional-use permit to use land for other than residential purposes. These petitions are considered on a case-by-case basis. Consideration involves public hearings before the board of adjustment (NPS LACH 1995c:8).

#### *Chelan County Code, Flood Hazard Development*

Development in flood hazard zones is limited by Chelan County.

##### Section 3.20.040 Purpose

It is the purpose of this chapter to promote the general public health, safety, and welfare, and to minimize public and private losses due to flood conditions in specific areas, by providing standards designed to:

- Protect human life and health;
- Minimize expenditure of public moneys and reduce the need for uneconomical flood-control projects;
- Minimize the need for rescue and relief efforts associated with flooding and usually undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities, such as water and gas mains and electric, telephone, and sewer lines, and streets and bridges located in flood hazard areas;
- Help maintain a stable tax base by providing for the sound use and development of flood hazard areas so as to minimize future flood loss;
- Ensure that potential buyers are aware that the property is located in a flood hazard area;
- Ensure that those who occupy the flood hazard areas assume responsibility for their own actions; and
- Satisfy the requirements established by the Federal Emergency Management Agency, as failure to do so would jeopardize federal financial support to the county and its citizens. (Res. 99-91 (part), July 6, 1999; Res. 89-56 Section 106, May 30, 1989).

### *Chelan County Emergency Resolution #2007-42*

On March 12, 2007, Chelan County issued an Emergency Resolution (#2007-42) declaring an "imminent danger at several locations in the Stehekin River and upper Lake Chelan due to increased flooding risk." The purpose of the Resolution was to "request that the Washington State Department of Fish and Wildlife issue an expedited written permit to perform work to reduce the flooding risk in the Stehekin Community." The Resolution identified several specific locations for flood protection measures, including upper Company Creek Road, based on concerns voiced by landowners and recommendations provided by the Corps of Engineers, Emergency Management Division (NPS LACH 2007:10 - 11).

# D. SUMMARY OF PUBLIC SCOPING

## 1. Overview

Public involvement is a key component of the NEPA process, where the general public, federal, state, and local agencies and organizations are provided an opportunity to help develop solutions and identify concerns and issues regarding the potential effects of proposed federal actions. The opportunity to provide input is called "scoping."

Internal scoping engaged professional staff of Lake Chelan NRA and the North Cascades NPS Complex and other NPS offices (Pacific West Region and Denver Service Center) to provide information regarding proposed actions that could affect Lake Chelan NRA resources. Internal scoping by NPS staff began in fall 2007. A variety of concerns were identified regarding vegetation, wildlife, maintenance, water resources, cultural resources and planning through participation in a formal internal scoping meeting held from October 28 -31, 2007. Comments were also solicited formally and informally from park and FHWA planning team members, from other agency staff, and from the technical committee. Internal scoping continued throughout the development of this document.

As a key step in the overall conservation planning and environmental impact analysis process, the NPS sought public comments and relevant information to guide the preparation of the DEIS. Among the objectives of this public scoping were to:

- Invite participation from federal, tribal, state, local governments and other interested parties;
- Inform all interested parties about the scope of the problem and the need to find solutions;
- Identify a preliminary range of management alternatives (in addition to a no-action alternative that would be used as a baseline of existing conditions from which to evaluate proposed changes in management);
- Identify substantive environmental (including natural, cultural, recreational and socioeconomic) issues which warrant detailed environmental impact analysis, and eliminate issues or topics which do not require analysis; and
- Identify potential environmental consequences and suitable mitigation strategies.

Public scoping was conducted through the following means: a press release describing the intent to begin the public involvement process through comments on the proposed project was issued on January 7, 2008; a newsletter was distributed to approximately 350 people on the park's mailing list and was available in park visitor centers; and it was announced via the park's website in January. In addition the formal Notice of Intent to prepare an EIS was published in the Federal Register on February 27, 2008.

The public outreach called for by Section 106 of the NHPA has been integrated into the NEPA process in accordance with the NPS Programmatic Agreement and Management Policies (2006a).

Informal preliminary scoping for the SRCIP / EIS began on January 22, 2008. During scoping, the NPS held three open house public meetings in Stehekin (January 22, 2008), Wenatchee (January 23, 2008) and Seattle (January 24, 2008). All parties wishing to express concerns or provide information about management issues which should be addressed in the forthcoming conservation planning and environmental impact analysis process were strongly encouraged to submit written comments.

Professional staff, including some members of the technical committee, was available to introduce the project, give presentations on scientific data, answer questions, and to accept comments. The public was encouraged to provide comments during the meetings and/or to submit written comments. The meetings were attended by approximately 73 people. There were 84 comments made at the Stehekin Public Meeting by 23 people who signed in, 73 comments made at the Wenatchee Public Meeting by 26 people who signed in, and 69 comments made at the Seattle Public meeting by 24 people who signed in.

Twenty-one public comment letters were also received: 16 from individuals, three from nonprofit organizations (The Wilderness Society, National Parks Conservation Association, North Cascades Conservation Council), one from the Environmental Protection Agency, and one from a business (Stehekin River Resort). These were received via PEPC (three letters), U.S. mail (12), and/or e-mail (6) and fax. Several were received both via e-mail and U.S. mail and one was received via U.S. mail and fax. These public comment letters included approximately 216 comments. One letter was mailed from California, all of the others listed Washington State addresses. Eight letters/e-mail identified a Stehekin address, two other individuals submitting letters/e-mail identified themselves as Stehekin property owners.

Comments were submitted directly to the park at the following address: North Cascades NPS Complex, Attn: SRCIP-EIS, 810 State Route 20, Sedro-Woolley, WA 98284. Comments were also submitted via the NPS Planning Environment and Public Comment (PEPC) website at http://parkplanning.nps.gov/noca or sent via e-mail to the superintendent, project manager or NOCA_planning@nps.gov. Information about the planning process was regularly updated and posted on the park's website: www.nps.gov/noca and on PEPC.

## 2. Summary of Concern Statements

### Public Scoping

The public comments from both the meetings and the letters (456) were sorted into 26 different specific-issue categories, three of which were further split to reflect the diversity of comments received. These ultimately resulted (from additional sorting and combining) in the 128 concern statements listed below plus the ones listed later that were considered but dismissed, or were outside the scope of the SRCIP. The comments have become part of the public record.

#### *Purpose and Need (3 comments)*

- The purpose and need should conform to NEPA and its implementing regulations.

#### *Alternatives (6 comments)*

- The alternatives should conform to NEPA and its implementing regulations.
- Alternatives that include heavy-handed manipulation of the Stehekin River are probably not within the scope of the plan.

#### *Vision/Philosophy (37 comments)*

- The plan should be holistic in its approach and should articulate clear goals and objectives that result in sustainable long-term management strategies.
- The SRCIP should identify and justify its area of potential effects.
- The alternatives should identify a wide range of management strategies to accomplish the purpose and need. Implementation of the alternatives will necessarily include trade-offs.
- The plan should balance the need for resources with effective management strategies that generate them. In doing so, it should involve the Stehekin Community.
- Scientific understanding of the effects of climate change should be applied to determining the vision for management.
- The plan should be comprehensive.

- The plan should identify criteria for valley development and have as its goal allowing for appropriate development while maintaining natural processes.
- The Stehekin Valley and Community were included in the national park system as part of Lake Chelan NRA because they are of national significance. Notwithstanding development, the protection of Stehekin resources should be a high priority to preserve for future generations.
- The Stehekin Community is a unique resource recognized by the enabling legislation for Lake Chelan NRA.
- The Stehekin River should not be modified to preserve or limit flooding effects on private property.
- There is an inherent conflict between preserving the Stehekin Community and allowing natural flooding to occur on the Stehekin River.
- The goal of the plan should reflect a long-term balance between allowing natural processes to continue unimpeded and allowing for appropriate sustainable (flood-protected) development, including safe public recreation, facilities, and private lands.
- There appears to be a conflict between the erosion control and flood protection actions NPS has taken in the Stehekin Valley and its assertion that it cannot act or expend funding to protect private property.
- Although NPS asserts that the original goal to remove private development from the main valley corridor is no longer valid, actions taken by NPS to protect Company Creek Road appear to be implementing that goal.
- The plan should include actions that would resolve issues in the whole lower valley.
- The plan should balance private property protection and fish habitat with respect to the accumulation of large woody debris.

### *Alternative Focus (4 comments)*

- One alternative should focus on minimal disturbance to natural systems.

### *Impact Topics (44 comments)*

#### Socioeconomic / Cumulative Impacts

- Land exchanges may affect the value of land in Stehekin or encourage speculation.
- A cumulative effects analysis of previous efforts by NPS and private landowners to install erosion and flood protection measures should be included. These measures have exacerbated the consequences of flooding on private property.
- A comprehensive analysis of the costs of the alternatives, encompassing the cost of purchasing remaining private lands, in comparison to continuing to install erosion and flood protection measures, should be included.

### Impairment

- The plan should include analysis of impairment and how it is applied. (Although impairment had routinely been discussed in environmental impact analysis documents, recent NPS policy now states that this discussion will be limited to the decision document. As a result, this will be discussed in the Record of Decision for the SRCIP.)

### Land Use

- Development in Stehekin should be clustered to minimize impacts.
- Public and private land use in each alternative should be evaluated to determine its ecological and visitor use consequences.

### Environmental (Natural, Cultural, and Social) Impacts

- A socioeconomic analysis of the impacts of land exchanges and other actions should be conducted.
- Among the impacts that should be included in the environmental impact analysis are the following: terrestrial and/or aquatic habitat loss, alteration, degradation, and fragmentation; indirect effects, particularly stimulated development, human activities, and impacts to wilderness values; cumulative effects to specific resources of concern; impacts to plant and animal species, particularly state- and federally listed (e.g., northern spotted owl, bull trout), candidate, and other sensitive species; impacts to water quality and/or drinking water; introduction and/or spread of invasive species; cultural, historical impacts, including those pertaining to tribes; hydrological alterations; stream bank hardening; loss and/or restoration of riparian areas; recreation and access; safety concerns; and costs.
- The plan should identify the consequences of changing the large woody debris management policy in Stehekin.

### Visitor Experience

- Analysis of the effects of the alternatives on visitor experience should be included.
- Analysis of the effects of the alternatives on recreational use should be included.
- Analysis of the effects of the alternatives on the Stehekin Community should be included.

### Natural Resources

- Analysis of the effects of the alternatives on natural resources (fish, vegetation, wildlife, soils, river hydrology, etc.) should be included.
- The Lower Field should not be considered for exchange due to its adjacency to northern spotted owl habitat.
- There is an apparent conflict between identifying the ecological sensitivity of the Lower Field with respect to northern spotted owls and identifying a proposed Stehekin Valley Road reroute above it. Other existing and potential ecological and human factors, such as fire and noise, also have effects on northern spotted owls.
- The use of pesticides should be carefully considered/should not occur near the Stehekin River.

### *Large Woody Debris / Sediment (30 comments)*

- Selective removal of gravel and large woody debris from the Stehekin River should occur to minimize impacts from flooding. There is an overabundance of these materials in the Stehekin River.
- The plan should determine the origin and need for large woody debris, including its role in the river system, and whether the number of logjams is appropriate.
- The plan should determine whether management changes are needed for large woody debris.
- Large woody debris could be used in engineered logjams.
- Logjams should be retained to minimize disruption to the ecosystem.
- Logjams should be removed (in some/all instances) to minimize flooding impacts.
- If large woody debris /gravel is not removed, it will continue to increase and contribute to the formation of logjams and increased impacts from flooding.
- There is a need to understand the origin of the wood in the logjams.
- The plan should determine how large woody debris manipulation could be used to enhance fish and wildlife habitat. Analysis of the need for large woody debris within the river system should occur.
- The amount of large woody debris now in the river is a natural phenomenon and was historically altered so that it is perceived now to be an overabundance.
- Removal of logjams will not fix problems related to flooding.
- The plan should determine the relationship of wood to gravel, especially the consequences of the accumulation of these at the Stehekin River mouth.
- Excess materials, including large woody debris and excavated gravel, generated by the plan should be used for other public and private projects in Stehekin.

### *Sediment (11 comments)*

- Sediment and large woody debris sources above High Bridge/in the whole Stehekin watershed should be identified.
- Road relocation/moving the road and allowing the river to encroach on the former roadway will result in the movement of sediment downvalley.
- Gravel mining may have unintended consequences elsewhere.

### *Land Exchange (68 comments, plus 6 related to impacts—see above)*

#### Land Exchanges: Lower Field

- Disposition of the Lower Field should be reconsidered. It should be removed from the 1995 Land Protection Plan list of eligible properties. The Lower Field is northern spotted owl habitat. The Lower Field offers good wildlife viewing opportunities.

### Land Exchanges: Concern About Need for / Desire for NPS Purchase

- Land purchase and exchanges are the most effective means of allowing the Stehekin River to migrate within its floodplain. Land acquisition is an effective means of allowing the river to migrate naturally.
- The effects of land exchanges on private property should be considered in the plan.
- Before any land is identified for exchange, there should be a survey of the need for additional exchange lands, analysis of the amount of property in the floodplain, analysis of eligibility for FEMA buyout, and other factors.
- The emphasis in the plan should be on land purchase, rather than exchange and on strategies to ensure the protection of existing public lands. Land exchanges and easements should be a secondary consideration.
- Public lands should not be exchanged. Exchanging public lands will adversely affect Lake Chelan NRA resources. Land exchanges may reward poor decision making (buying land within the floodplain).
- Land exchanges have a variety of adverse effects, including shifting development to high ground, taking unfair advantage of government resources, encouraging development and speculation, and resulting in increased development.
- Consider the Walker property for land exchange.
- Condemnation of lands should be considered in the Land Protection Plan.
- NPS should seek funding for land acquisition.
- The plan should establish criteria for land exchanges and analyze effects on adjacent lands and values.
- Justification for a revised Land Protection Plan should be included in the plan, followed by systematic evaluation of the relative values of public lands identified for exchange. Evaluation should include those lands that might be available for acquisition instead of exchange.
- Land exchanges should/should not occur in the Stehekin Valley.
- There should be a list of available lands for exchange in the plan. Lands adjacent to private property in Keller's Park should not be on the list.
- The plan should identify whether floodplain lands can be exchanged for lands at higher elevation and whether partial exchanges of flood-affected portions of private property can occur.
- Land exchanges may include covenants/restrictions. Exchanged lands should have the same development rights.
- The plan should include and identify the benefits of clustering development.
- Proposed land acquisitions and exchanges should be evaluated with respect to management viability and access.

Land Exchanges: Availability

- There are few lands available for exchange compared to the amount of private land within the floodplain.
- Other strategies (beyond land exchanges) may need to be used in the plan to remove private lands from the floodplain.
- The criteria for evaluating whether to offer public lands for exchange should be revisited, including the aesthetic criteria and whether an entire parcel should be excluded for one criterion.
- Land exchanges should be limited to those lands with low resource or scenic values.

Land Exchanges: Priority Setting

- Land exchanges should focus on removing private lands from the floodplain.
- The plan should identify the criteria for prioritizing land exchanges.

### *Jurisdiction (12 comments)*

- Land management agencies with responsibility for Stehekin should cooperate in the plan.
- The plan should describe consultation with Native American Tribes.
- The plan should identify jurisdictional responsibility along the Stehekin River, especially at the mouth and with respect to floating or submerged large woody debris.
- The plan should clarify the jurisdiction and management of large woody debris for NPS and private landowners.

### *Policy/Regulation Changes (6 comments)*

- The plan should clarify the policy for and management of gravel mining.

### *Potential Modifications to GMP (5 comments)*

- The plan should make changes to the management of large woody debris.
- The plan should reaffirm the GMP policy of manipulating large woody debris to minimize recreational boating impacts.
- The plan should clarify how the GMP can be modified.

### *Fisheries Habitat (10 comments)*

- The plan should identify the ecological need for large woody debris and how the amount now present relates to that need. Large woody debris should be used for bank protection and erosion control.
- The plan should identify the ecological benefits of large woody debris for fish and fish habitat.
- The plan should identify whether large woody debris left high and dry is beneficial to fish or whether it could be available for use.

### *Floodplain Facilities / Mapping (13 comments)*

- The plan should identify options for floodplain mapping, including the advantages and disadvantages of each.
- The plan should take into account the time needed to develop new FEMA floodplain maps.
- New floodplain maps are key to determining sustainable management strategies in the plan.
- The plan should identify what facilities would be allowed to remain in the floodplain and why.
- The plan should evaluate public essential and nonessential facilities in the floodplain and whether they are still needed and should be relocated.
- The plan should identify if there are any structures (other than buildings) that should be removed from the floodplain.

### *Stehekin Community Principles / Viability (14 comments)*

- The plan has the potential to affect the viability of the Stehekin Community if additional private lands are purchased or exchanged. There should be no reduction in the amount of private land within the Stehekin Valley.
- The proposed clustering of development will affect the privacy of landowners who purchased lands away from other developed lands.

### *Proposed Projects (26 comments)*

- The plan should consider what would occur if the Stehekin River changes course at Buckner Homestead hayfield and pasture.
- The 12 projects identified as potentially needed at the public scoping meetings should be implemented.
- The plan should consider taking a broad look at long-term visitor needs in the Stehekin Valley, including changes to the location or configuration of campgrounds and potential demand for additional low-elevation camping.
- The plan should consider implementing work to protect the road/private property north of Milepost 5.5.
- Bank erosion above the Stehekin River Resort should be stabilized.
- The plan should identify opportunities for public-private partnerships on proposed projects.
- The plan should identify removal of gravel and/or large woody debris from the head of the lake to minimize flooding impacts to the river mouth and hazards for recreational boaters.
- The plan should consider taking action near Frog Island [and at the maintenance facility].
- The plan should leave the logjams at McGregor Meadow and No Name Creek in place.
- The plan should include replacement and relocation of NPS facilities in the floodplain, including the maintenance yard.

- The plan should identify future problem flooding areas and plan for them before they occur.
- The plan should encourage Chelan County to modify zoning related to floodplain development.
- The plan should identify whether gravel bars can or should be manipulated.
- The plan should consider filling the deep channel on the White property.

### *Erosion Protection (8 comments)*

- The plan should consider/should avoid additional actions to stabilize the banks of the Stehekin River.
- The placement of large woody debris for erosion protection/flood control can result in downstream effects.
- Adding bank hardening, such as levees, may result in exacerbating the effects of flooding.

### *Road Relocation (27 comments)*

- If road relocation threatens private property, that property should be added to the list of those that have the option for land exchange.
- The Stehekin Valley Road should/should not be relocated.
- The plan should identify how private landowners will access their property should the road be relocated.
- Access roads could be minimally constructed/maintained.
- Rerouting the road will affect the stability of properties it is rerouted around.
- Constructing and maintaining rerouted roads will have a wide array of adverse effects.
- Modifications to Company Creek Road need to be considered in the plan.
- Work done on the Company Creek side of the Stehekin River has adversely affected properties on the Stehekin Valley Road side. No comparable work has been done to protect them.

### *Emergency Planning / Landowner Interim Actions (23 comments)*

- The plan should address emergency actions landowners can take.
- What criteria define how landowners can treat large woody debris, including floating logs, on their private property? What permits are needed?
- Private landowners can take action to install flood protection measures on their own property. NPS should provide technical assistance to landowners undertaking flood protection measures and emergency actions.
- Agencies have a responsibility to communicate flooding risk to landowners so they can take action.

### *Agency/Political/Community Involvement and Technical Assistance (9 comments)*

- There should be increased involvement of the U.S. Army Corps of Engineers, politicians, technical experts and the Stehekin Community in the planning process and its outcomes.
- Technical assistance is needed for Stehekin landowners.
- Educational and interpretive, as well as technical, information related to flood protection and climate change needs to be more available for Stehekin landowners, residents, and the general public.

### *Recreational Use (4 comments)*

- The plan should determine the effect of the accumulation and management of large woody debris on recreational uses.
- Effects on the viability of the Lower Valley Trail should be considered in the plan.
- A recommendation that modifications to the River Trail be included in the plan.

### *Water Quality (2 comments)*

- Flooding of septic systems has an effect on water quality. Good water quality is important to maintain for the Stehekin Community water system.

### *Research / Climate Change Issues (6 comments)*

- The flooding regime on the Stehekin River has been affected by climate change. Future effects are unknown.
- Ongoing effects from climate change need to be projected to the degree possible to aid in planning for the future. Climate change effects need to be considered in the environmental analysis.

### *Restoration (2 comments)*

- Restoration of purchased and exchanged lands, as well as abandoned sections of roadway, should occur.

### *Funding the SRCIP (8 comments)*

- How will plan implementation be funded? Funding of proposed actions should be identified and addressed.
- The costs of alternatives should be determined.

## Issues and Concerns Addressed in this Document

All of the above issues and concerns were considered in the planning process or are addressed in this document except for those identified under the next heading.

## Issues Considered but Dismissed

The following issues were initially considered by the planning team, but were eventually rejected for various reasons. This reasoning is given in Chapter II: *Management Alternatives* under the heading "D. Alternatives and Actions Considered but Dismissed" (from further review).

- The scope of the plan should include the entire Stehekin River watershed, including wilderness area above High Bridge.
- The Stehekin River should be contained within a channel to reduce flooding of private property and public facilities.
- The goal of the plan should be to allow natural processes to occur unimpeded so that natural flooding can continue to occur without regard to its effect on facilities and private property.
- Plan alternatives should include consideration of rerouting the Company Creek Road.
- There is a great deal of suitable gravel for Stehekin projects in the valley that could be used instead of importing materials at high cost.
- Pile burning of large woody debris generated by the plan should be considered.
- Sediment and large woody debris sources above High Bridge/in the whole Stehekin watershed should be evaluated for treatment.
- Gravel removal should be used instead of land exchanges.
- Dredging should be part of the plan as long as it is done in a way that minimizes impacts.
- The plan should consider changes to the *Sand, Rock, and Gravel Plan* to allow use of gravel generated by plan actions.

## Issues and Concerns Outside the Scope of this Document

The following issues generated through public scoping are not within the scope of this project and are therefore not analyzed in detail in the document:

- Concern that the plan would modify the wilderness boundary.
- A recommendation to include plans for the road/trail above High Bridge.
- Selective tree removal in the upper valley may have an effect on reducing logjams. Plan actions should reduce the potential for the additional formation of logjams.
- A recommendation that the plan include establishment of the Bridge Creek hiker's hostel.

These actions are outside the scope of the proposed plan because they include actions that would take place above High Bridge (outside the project area that has been defined for the plan) or because they are actions that are not related to the effects of flooding on public facilities and private lands within the Stehekin Valley. They are therefore not considered in the accompanying analysis.

The following two issues were also brought up during public scoping:

- Concern about the Lake Chelan NRA using the most effective strategies for treating invasive plants, including comparing the strategies with respect to cost, repeated applications of pesticides, nonchemical means of control, effectiveness/use in other areas, and the effects of pesticides on water and non-target plants and wildlife.
- A recommendation that volunteer groups be used in invasive plant management.

These actions are beyond the scope of the proposed project. Although invasive plant management would continue to occur, the SRCIP is not the means under which planning for invasive plant treatment is orchestrated. Lake Chelan NRA recently completed an Invasive Plant Management Plan, and these comments were considered in that EA.

Included in public scoping was:

- A recommendation that the plan include actions for supporting sustainable economic activity in Stehekin.

Although the SRCIP considers economic impacts associated with changes in land use in Stehekin, creating a plan that would create sustainable economic activity in Stehekin is beyond the scope of the proposed plan.

Some comments suggested items that the park could consider in future Stehekin planning, including:

- Concern that the need to relocate campsites or campgrounds be part of a much larger plan for long-term visitor use in the Stehekin Valley.
- Concern that there would be increased demand for low-elevation camping as lodging costs increase.

A long-term plan for campground management/dealing with increasing lodging costs in Stehekin is beyond the scope of managing flood-related impacts in the river corridor. Because these actions are not part of the plan, they are not considered in the accompanying analysis. What is considered are modifications to the use of campsites consistently affected by flooding and the development of new campgrounds to replace these, as well as the relocation of a camp affected by hazard trees.

The following concerns are related to the plan, but are not within the scope of the plan to solve:

- Land exchange appraisals should consider the effects of flooding.

There would be no changes to the way land exchange appraisals are conducted for the plan. Land exchange appraisals are conducted under a set of laws, regulations, policies, and professional appraisal standards, which take into consideration flood-related impacts to buildings, access, and structures. This plan does not supersede this legislative or policy direction. It should also be noted that appraisals do take into account the elements that contribute to fair market value.

- Stehekin landowners need an emergency response plan.

Emergency response on private property is under the jurisdiction of Chelan County. The NPS has been coordinating, and will continue to coordinate, with the County on emergency-response planning and actions, including by providing staff to assist with planning.

- Plan alternatives should focus on climate change, or climate change educational opportunities.
- Future impacts and costs associated with climate change should be modeled and predicted in the plan.

All alternatives are based on ongoing research related to potential impacts from climate change, river dynamics, and flooding. Analysis of flood data for the last century points to a shift in the Stehekin system from one dominated by spring floods to one dominated by larger fall events. The analysis of the alternatives considers how this changing flood regime will influence the proposed actions within the project area. Modeling future climate change and its effect on flooding is beyond the scope of the plan. Further, uncertainty in the pace or pattern of changes caused by global climate change precludes making specific management decisions based on models. In the same way, focusing the alternatives on climate change would not result in a wide range of options to address flooding of public and private property in the Stehekin Valley.

- The plan should identify management policies that should be changed.
- Public domain lands (never in private ownership) should be considered for exchange.

Changing government and NPS policies is a lengthy and controversial process that is beyond the scope of the plan.

- Designate/do not designate the Stehekin River as a Wild and Scenic River.

The SRCIP is not the right vehicle for a Wild and Scenic River designation for the Stehekin River. That process requires a separate study, which is currently unfunded. Nonetheless, the lower Stehekin River is eligible for Wild and Scenic River designation for its recreational values. In adherence to NPS *Management Policies 2006* (NPS 2006a), however, the SRCIP will not affect the criteria which make the Stehekin River eligible as a Wild and Scenic River (see Chapter IV).

## 3. Management Alternatives Scoping

Additional public scoping took place during the alternative development period. Three public open houses were held, two in Stehekin (August 26 - 27, 2008) and one in Seattle (August 28, 2008). In addition, 17 comment letters were received via fax (1), PEPC (3), e-mail (8), or regular mail (6)—some were received in more than one format.

The 17 letters were received from 12 individuals (some duplicate or signed by more than one person), three nonprofit organizations (National Parks and Conservation Association, Western Lands Project, and Stehekin Heritage); one school district (Stehekin School District); one county government (Chelan); and two businesses (Island Resources, Ltd. and Stehekin River Resort).

These letters contained approximately 65 individual comments, summarized as follows in the following 62 concerns:

## Alternatives

### *General*

- There should be a “community” alternative that would show increased cooperation among federal, state, county, and private parties.
- There is support / lack of support for various alternatives and portions of alternatives.
- Wild and Scenic River designation for the Stehekin River should be considered in the plan.
- The proposal for the Stehekin Valley Trail should be more fully developed, including how it relates to the plan (including impacts from relocating the road on the Old Wagon Road proposed alignment).
- There should be additional interpretive information about living in Stehekin as part of the proposed plan.
- There are ongoing concerns about gravel accumulation.
- There is concern about paving unstable sections of the Stehekin Valley Road.
- What will happen to the existing maintenance facilities (including the YACC yard)?

### *Implementation*

- The SRCIP should include an implementation plan with a timeline and identify potential funding sources, both public and private.
- There were questions about the details of implementation that are not fully described within the current array of alternatives (in the newsletter).
- There were questions about the cost of implementing the alternatives.

### *Drainage Modifications*

- There should be routine preventative maintenance on culverts and drainages.
- Wilson Creek flow is outside the channel, causing it to make a circuitous route back to the culvert, overflowing the road.
- Jonathan Creek is plugged.
- Culverts and catch basins should be checked in the spring and fall.

### *Vehicle Turnaround*

- There were questions about the vehicle turnaround and other measures that are incorporated into the plan as a result of the Stehekin Valley Road Improvement Project implementation.
- There was concern about the large size of the parking area / turnaround.

### *Large Woody Debris Management*

- There was concern about whether or not large woody debris manipulation is included in the alternatives.
- There was a question about the alternatives proposing NPS vs. private use of large woody debris.
- The SRCIP should include active and ongoing management of large woody debris in the Stehekin River and provide opportunities for relocation of large woody debris within the system.

### *Bank Erosion Protection*

- The NPS should implement immediate bank-protection action on NPS land to protect the Stehekin River Resort.
- Erosion protection measures on NPS land above the Stehekin River Resort would protect private property.
- The plan should include additional bank-hardening measures.
- The Stehekin River should not be confined.
- Additional information about bank-protection measures, such as cabling logs, should be provided.
- Current and future bank stabilization projects where both private and public lands are involved should be approached in a comprehensive manner.
- The plan should use a reach-based approach that considers an entire project regardless of land ownership to design bank stabilization projects.

### *Reroutes*

- There were concerns about private property being on "the wrong side" of the reroute due to the protection measures afforded the public access route (along the Stehekin Valley Road).
- The cost of /need for the reroutes was questioned.
- There were concerns about future access to McGregor Meadows when the reroute is implemented.
- The plan should address concerns about utility, firefighting, and other access as well as egress on the former Stehekin Valley Road access to McGregor Meadows if a reroute is implemented.
- Impacts to downstream neighbors should be included in reroute decisions.
- The access road through McGregor Meadows might not be maintained to a standard that would allow protection of adjacent properties.
- The cost of reroute alternatives in comparison to annual maintenance and maintenance of the proposed access road was questioned.
- The reroutes may be subject to rockslides, and snow and debris avalanche risk.

### *Recreational Development*

- The group camp near Rainbow Falls would be more desirable than the north bank of Company Creek.
- There was a question about the need for raft ramps at Harlequin and above the Stehekin River Resort based on the volume of rafting and the impacts, when there is a raft ramp at Bullion.

## Land Acquisition and Exchange

- Land exchanges may not provide a public benefit.
- There should be a moratorium on land exchanges until all parcels have been made available (post EIS).
- The corral land near the bakery should be considered for land exchange.
- The plan may result in the continued loss of private property in Stehekin.
- There is erosion of the private land base in Stehekin and potential long-term negative effects of that on the Stehekin Community.
- The Land Protection Plan should provide financial assistance as well as purchase for property owners willing to relocate out of the channel migration zone.
- The Rice property should not be exchanged.
- There would be impacts to the Stehekin School from proposed land exchanges, including adjacency of private vs. public property, particularly from the Rice property.
- There were questions about the NPS's use of land acquisition / exchange as a strategy and how it relates to U.S. Forest Service use of the same (i.e., why the NPS does not have a step-by-step policy).
- The plan may concentrate activity in the lower valley.
- There was a question about whether an existing life-estate where the Stehekin River has occupied the property would qualify for exchange.
- There was concern about the Webb-Walker and the Griffin-Getty properties on the list of potential exchange lands.
- The lands available / potentially available / unavailable for exchange were inadequately portrayed on maps at the public open houses in Stehekin and Seattle.
- Land exchanges should include the removal of not only buildings from the floodplain but also the water systems, septic systems, and electrical systems (including septic tanks, plastic infiltrators, conduit, plumbing, well casings, pumps, etc. buried in the ground).
- The above items should also be removed when NPS acquires developed lands.
- There should be oversight and completion inspections to ensure removal of NPS acquired structures.

- NPS buildings that were torn down this summer still have water systems, wastewater systems, and power conduits buried in the ground at these sites. NPS should remove this buried utility system infrastructure.
- All proposed land exchange property should meet the criteria of nonfederal ownership.
- There was a question about whether the property adjacent to and upvalley of the Stehekin Ranch was part of the Maxwell homestead.
- The criteria used to determine NPS property eligibility for exchange should consider the channel migration zone before other priorities, such as wildlife.
- Land exchanges should be a high priority in the final plan.
- Chelan County offered a commitment to working with NPS to address zoning and cluster development opportunities that may help to facilitate additional land exchanges.

## Other Questions

There were questions about:

- Whether the road would be elevated through McGregor Meadows if the reroute was implemented
- Jurisdiction and a request for resolution of it by the NPS related to large woody debris build-up
- Where the alternatives would allow the manipulation of large woody debris.

All of these were considered in the additional development of the alternatives except the following, which are (at least) partially outside the scope of the proposed plan (explanations follow):

- The NPS should implement immediate bank-protection action on NPS land to protect the Stehekin River Resort.

The NPS is prohibited from expending funds or taking actions specifically to protect private property. In addition, actions proposed within the context of this plan must undergo environmental analysis and approval in a Record of Decision before implementation can occur.

- There should be a moratorium on land exchanges until all parcels have been made available (post EIS).

Land exchanges were specifically included within the scope of the plan because they are currently available as a protection strategy under the 1995 plan (NPS LACH 1995b). The NPS cannot alter the LPP priority system without modification to the LPP, which is being done as part of this planning process.

- The Land Protection Plan should provide financial assistance as well as purchase for property owners willing to relocate out of the channel migration zone.

The NPS cannot provide financial assistance to landowners for exchange or acquisition, except where it is specifically authorized due to the need for compensation for unequal exchange property values or where it adds value to land purchases.

- There were questions about NPS's use of land acquisition / exchange as a strategy and how it relates to U.S. Forest Service use of the same (i.e., why the NPS does not have a step-by-step policy).

The NPS does not have a "cookbook" of how to conduct land acquisition or exchanges, because compared to other agencies, like the Bureau of Land Management (BLM) or U.S. Forest Service (USFS), the NPS conducts a very small number of exchanges and the criteria that allow NPS exchanges are more narrowly defined.

In addition, because the following concern was raised during initial scoping, reasoning for its exclusion is given above (see "C. Issues and Concerns outside the Scope of this Document"):

- Wild and Scenic River designation for the Stehekin River should be considered in the plan.

# E. IMPACT TOPICS

This section describes the issues developed with public involvement during the planning process. It also includes the impact topics which will be carried forward in the analysis of the alternatives. Impact topics are the potentially affected resources. Laws or policy related to their inclusion in this EIS are also noted. This section also identifies those resources that have been dismissed from further analysis due to their having no identified or negligible potential environmental consequences.

## 1. Introduction

NPS resource specialists and planning staff identified issues and concerns that may have an effect on or be affected by actions in the proposed alternatives. Other agencies, including Chelan County, the Washington State Department of Fish and Wildlife, and the U.S. Army Corps of Engineers provided input at meetings and through the Technical Committee. Permanent and seasonal residents of the Stehekin Valley and the general public provided comments at meetings and open houses.

Impact topics have been identified on the basis of the NPS *Management Policies 2006* (NPS 2006a), federal laws, regulations, and orders, and NPS staff knowledge of resources in the Stehekin Valley. Additional issues and concerns were identified from internal scoping responses and public meetings held in Stehekin, Wenatchee, and Seattle. Some of the main issues and concerns included the following:

- Frequent flooding of the Stehekin Valley Road impacts Lake Chelan NRA operations and visitor experience by reducing access to the interior of the park.
- Construction of riverbank erosion protection measures would impact water quality and streamflow, because it would be necessary to perform in-water work and the proposed rock barbs would alter streamflow. These structures also affect the natural erosion process of the river.
- A series of actions related to maintaining the Stehekin Valley Road and Company Creek Road, including raising the roadbed, road reroutes, and bank stabilization, would occur within the floodplain / channel migration zone of the Stehekin River and could affect their characteristics.

- Construction activities would temporarily increase noise that may affect visitor experience in the wilderness area surrounding the road.
- Soils and vegetation would be impacted by the road reroutes, which would require clearing and grading and removal of soils and vegetation.
- Proposed road reroutes could impact threatened and endangered species in areas where the road is moved closer to occupied habitat. Actions could include habitat removal, increased long-term noise from road traffic and human disturbance, and temporary construction noise.
- Gravel roads cause dust, and impacts to water quality, vegetation, and visitor experience. Maintaining gravel roads also requires either gravel extraction from the Lake Chelan NRA Company Creek borrow pit, which is a limited resource, or importing material by barge, which is expensive.

NPS staff consolidated the issues and selected the impact topics described below to facilitate the analysis of environmental consequences. A brief rationale for the selection of each impact topic is given below. In addition, a discussion of impact topics dismissed from further consideration and the rationale for dismissing them is located in the following section.

## 2. Impact Topics Analyzed

Impacts of each action and alternative have been analyzed for the topics discussed below. These impact topics focus the discussion on comparing the environmental impacts among alternatives on affected resources.

### Physical Resources

#### *Land Use*

NPS *Management Policies 2006* (NPS 2006a) provides direction for protection of lands and resources within park units, acquisition of nonfederal lands that are within park units, and cooperation with agencies, tribes, and private property owners to provide appropriate protection measures. The Lake Chelan NRA GMP (NPS LACH 1995a) provides the framework for the types of land uses allowed within the project area. Land use refers to the general characteristics of how land is allocated among various administrative, preservation, recreational, and development needs. Management zones were established under the Lake Chelan NRA GMP and land use priorities were identified in the LPP (NPS LACH 1995c). Because land use could change as a result of the implementation of the action alternatives, it is included as an impact topic.

#### *Air Quality*

The Clean Air Act of 1963 as amended (42 USC 7401 et seq., PL 88-206) was established to promote the public health and welfare by protecting and enhancing the Nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality-related values associated with NPS units. Section 118 of the CAA requires a park unit to meet all federal, state, and local air quality pollution standards.

Lake Chelan NRA is a class II area under the CAA. The surrounding North Cascades National Park and Glacier Peak Wilderness are class I areas. Class II areas allow only moderate increases in certain air pollutants, while class I areas (primarily large national parks and wilderness areas) are afforded the highest degree of protection, meaning that very little additional deterioration of air quality is permitted. The Act states that park managers have an affirmative responsibility to protect air quality-related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse air pollution impacts (EPA 2000). Because road rehabilitation and construction could affect air quality, air quality is included in the impact topics.

### *Geologic Hazards*

Geologic hazards are common within Lake Chelan NRA and include earthquakes, rock falls, debris flows, and swift mountain streams. The proposed alternatives would have measurable effects on increasing or reducing impacts from or exposure to some geologic hazards. Within the proposed project area hazards exist at the following locations: alongside steep valley slopes on the edge of the moraine at McGregor Meadows; at Milepost 8.0 (from the steep slope beyond the angle of repose); rock fall hazards off the steep valley side walls (Alternatives 2, 3, and 5); and debris cones along the reroutes in Alternatives 2, 3, and 5. Because of the potential impacts of the alternatives on these processes, geologic hazards are included as an impact topic.

### *Soils*

*Management Policies 2006* (NPS 2006a) require the NPS to understand and preserve and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil. The alternatives include ground-disturbing activities of previously disturbed and undisturbed soils. Road reroutes would result in alteration of geomorphology (land forms) because of proposed road cuts and slope regrading. The concurrent loss of vegetation would also likely increase the potential for erosion and cause additional alteration of soil properties. Therefore, soils impacts are included in this document.

### *Water Resources*

The 1972 Federal Water Pollution Control Act, as amended by the CWA (33 USC 1251 et seq., PL 92-500 and PL 95-217), is a national policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters, to enhance the quality of water resources, and to prevent, control, and abate water pollution. *Management Policies 2006* (NPS 2006a) provides direction for the preservation, use, and quality of water in national parks.

#### Water Quality

Section 401 of the CWA as well as NPS policy requires analysis of impacts on water quality. The Stehekin River is a Category 1 waterway that is given maximum protection under state water quality regulations (WAC 173-201A). The alternatives would take place within, and in close proximity to, the Stehekin River. Construction activities may include in-water work and earth disturbance, which increases the potential for erosion and sedimentation to occur and can adversely impact water quality. In addition, the current annual maintenance of the Stehekin Valley Road requires replenishment of gravel on the roadway. The use of this material on the road is a source of continuing sediment input to the Stehekin River from road/riverbank erosion, where those areas of the road are located in close proximity to the river from flooding, and major stormwater runoff. Because of potential impacts from sedimentation and work that might occur within and next to the Stehekin River, water quality is addressed in this EIS.

### Hydraulics and Streamflow

The Lake Chelan NRA GMP (NPS LACH 1995a) provides guidelines for the implementation of actions that affect the Stehekin River, its tributaries, and the Stehekin Valley Road. The GMP allows manipulation of the river only for road projects in erosion/river conflict zones under certain conditions. The Stehekin River is prone to severe flooding in spring and fall, which periodically damages the roadway. The largest floods recorded occurred in 1948, 1995, 2003 and 2006, and have caused major changes to the river and associated damage to the Stehekin Valley Road and Company Creek Road. When extreme flood velocities and depths occur, rapid erosion of the riverbank and road may occur. The proposed alternatives would involve riverbank improvements to protect the road, which may affect hydraulics and streamflow.

### Wetlands

Executive Order 11990 requires that impacts to wetlands be addressed. Numerous wetlands are located along the Stehekin River.

Section 404 of the Clean Water Act requires federal agencies to avoid, minimize and mitigate impacts to wetlands. Executive Order 11990, NPS *Management Policies 2006* (NPS 2006a), and *Director's Order 77-1: Wetland Protection* (NPS 2002a) direct that wetlands be protected and that wetlands and wetland functions and values be preserved. They further direct that direct or indirect impacts to wetlands be avoided whenever there are practicable alternatives. Actions within the alternatives would affect wetlands along the edge of the Stehekin River (see Appendix 17: *Draft Wetlands and Floodplains Statement of Findings*). Less than two percent of Lake Chelan NRA is comprised of riparian wetlands.

### Floodplains

Executive Order 11988 (Floodplain Management) requires an examination of impacts to floodplains and potential risk involved in placing facilities within floodplains. NPS *Management Policies 2006*, The Planning Sourcebook (General Management Planning) NPS 2005, and *Director's Order 12* (Conservation Planning, Environmental Impact Analysis, and Decision Making) (NPS 2001a), and *Director's Order 77-2* (Floodplain Management Guideline) (NPS 2003b) provide guidelines for proposals that occur in floodplains. Executive Order 11988 requires that impacts to floodplains be addressed (see Appendix 17: *Draft Wetlands and Floodplains Statement of Findings*). A key purpose of the SRCIP is to remove development from the Stehekin River floodplain / channel migration zone to the extent possible.

## Biological Resources

### *Vegetation*

NEPA calls for examination of the impacts on the components of affected ecosystems. *Management Policies 2006* (NPS 2006a) calls for protecting the natural abundance and diversity of park native species and communities, including avoiding, minimizing, or mitigating potential impacts from proposed projects. The alternatives are likely to result in tree removal and other vegetation loss as well as enhancement or restoration of vegetation. Therefore, vegetation is included as an impact topic in this document.

### *Wildlife*

NEPA calls for examination of the impacts on the components of affected ecosystems. NPS policy is to protect the natural abundance and diversity of park native species and communities, including avoiding, minimizing, or mitigating potential impacts from proposed projects. More than 163 native species of terrestrial and aquatic vertebrates have been recorded in the park, including 40 mammals, 104 birds, eight reptiles, five amphibians, and six native fish (Kuntz and Glesne 1993; Duke Engineering and Services [DES] 2000). Many wildlife species may reside in or near the project areas. The alternatives will involve impacts to wildlife such as the removal of wildlife habitat, increased noise levels caused by construction activities, and increased turbidity caused by work in water. The loss or alteration of habitat has a direct effect on wildlife, which is often greatest when it affects their nesting/denning and foraging areas. Therefore, wildlife is included as an impact topic in this document.

### *Special Status Wildlife*

The Federal ESA requires an examination of impacts to all federally listed threatened or endangered species. NPS *Management Policies 2006* (NPS 2006a) calls for an analysis of impacts to state-listed threatened or endangered species and federal candidate species. Under the ESA, the NPS is mandated to promote the conservation of all federally listed threatened and endangered species and their critical habitats within the park and Lake Chelan NRA boundary. NPS policy also requires examination of the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species. Ongoing informal consultation with the USFWS and the WDFW has identified several important rare, threatened, and endangered species that occur in Lake Chelan NRA. Therefore, special status wildlife is included as an impact topic in this document.

## Cultural Resources

### *Prehistoric and Historic Archeological Resources / Historic Structures / Cultural Landscapes*

Consideration of the impacts to historic properties is required under provisions of Section 106 of the NHPA (1966), as amended, and the 2008 NPS Programmatic Agreement among the NPS, the National Conference of State Historic Preservation Officers, and the Advisory Council on Historic Preservation (NPS et al. 2008). It is also required under the NPS *Management Policies 2006* (NPS 2006a). Conformance with the Archeological Resources Protection Act in protecting known or undiscovered archeological resources is necessary. NPS *Management Policies 2006* calls for ongoing inventory and analysis of the significance of archeological resources found within parks. Federal land managing agencies are required to consider the effects proposed actions may have on properties listed in, or eligible for inclusion in, the National Register of Historic Places (i.e., Historic Properties), and to allow the Advisory Council a reasonable opportunity to comment. Agencies are required to consult with federal, state, local, and tribal government/ organizations, identify historic properties, assess adverse effects to historic properties, and negate, minimize, or mitigate adverse effects to historic properties while engaged in any federal or federally assisted undertaking (36 CFR Part 800). Therefore historic structures / cultural landscapes are included as impact topics in this document.

There are 33 archeological sites recorded in Lake Chelan NRA. Of these sites, 25 are prehistoric. An archeological survey near and within the Stehekin Valley Road Improvement Project area was conducted in June of 2004 and no pre-contact-age archeological sites were located. Because, however, there is a potential for previously unknown archeological resources to be found, prehistoric and historic archeological resources are included as an impact topic in this document.

## Recreational / Social Resources

### *Visitor Experience*

Providing for the enjoyment of national park resources is one of the foundations of the NPS Organic Act. The Organic Act directs the NPS to promote and regulate the use of national parks to conserve resources and to provide for their enjoyment by existing and future generations. In accordance with this act, NPS *Management Policies 2006* (NPS 2006a) and *Director's Order 17* (Tourism) (NPS 1999) identify visitor use patterns and the desired visitor carrying capacity, and allow for appropriate recreational activities within park units. The Lake Chelan NRA LPP (NPS LACH 1995b) calls for the protection of cultural and natural resources and the provision of safe visitor facilities and services. In addition, the enabling legislation for Lake Chelan NRA has as one of its goals to provide for public outdoor recreation use and enjoyment of the Stehekin River and Lake Chelan. Depending on the selected alternative, a variety of impacts to visitor use may occur. The impacts considered in this section related to visitor use, include access and transportation, visitor use opportunities, interpretation and education, safety, and scenic resources.

### *Wild and Scenic Rivers*

The Stehekin River, throughout its entire length, is considered eligible for Wild and Scenic status. Under the Wild and Scenic Rivers Act (16 USC 1271 - 1287), "certain selected rivers of the Nation, which with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations." As noted in *Management Policies 2006*:

> *Potential national wild and scenic rivers will be considered in planning for the use and development of a park's water and related land resources. The Park Service will compile a complete listing of all rivers and river segments in the national park system that it considers eligible for the National Wild and Scenic Rivers System. General management plans and other plans potentially affecting river resources will propose no actions that could adversely affect the values that qualify a river for the National Wild and Scenic Rivers System. After a determination of eligibility is made, a decision concerning whether or not to seek legislation to designate a river or river segment may be made only through a general management plan, an amendment to a general management plan, or the legislative review process. (NPS 2006a:2.3.1.9)*

If the Stehekin River were designated as a National Wild and Scenic River, a 0.25-mile corridor on either side of the river would be designated to preserve its Wild and Scenic values. Some components of the alternatives under consideration could have beneficial or adverse effects on the free-flowing characteristics of the river and/or some of its outstandingly remarkable values. Therefore, wild and scenic rivers is included in this document

### *Park Operations*

Impacts to park operations and visitor services are often considered in environmental documents to disclose the degree to which proposed actions would change park management strategies and methods and what additional costs (including staffing) are associated with the proposal. The alternatives would affect short- and long-term transportation and access, as well as the quality of the transportation infrastructure and the ability of the park to maintain the infrastructure and conduct park operations. The Stehekin Valley Road is the primary access to Lake Chelan NRA and also provides access to North Cascades National Park. The road is used by staff to conduct resource surveys, maintain park facilities, perform hazard fuel reduction (including prescribed fire), and to assist visitors / protect park resources. Therefore, park operations is included in this document.

### *Socioeconomics*

Socioeconomic impact analysis is required, as appropriate, under NEPA and *Management Policies 2006* (NPS 2006a) pertaining to gateway communities. Because of the unique nature of Lake Chelan NRA, it is also appropriate to address it with respect to the Stehekin Community and Chelan, where most visitors embark on their Lake Chelan NRA visit. The local and regional economy and most business of the communities near the park are based on tourism and resource use. Agriculture, manufacturing, professional services, and education also contribute to regional economies. Therefore, socioeconomics is included as an impact topic in this document.

### *Hazardous Materials*

There are a variety of opportunities to encounter hazardous materials in the proposed project area under Alternatives 1 - 5. Therefore, this topic has been included.

# 3. Impact Topics Dismissed from Further Analysis

The topics listed below either would not be affected by, or would be affected only negligibly by, the alternatives evaluated in this document. Therefore, these topics have been dismissed from further analysis. Negligible effects are localized effects that would not be detectable over existing conditions. Many of these effects would be short term and would occur only as a result of construction activities. A detailed rationale for dismissing these and other impact topics is given below.

## Water Quantity

There would be no major changes in the use of water associated with the implementation of the alternatives. Replacement and relocation of the maintenance area has the potential to decrease administrative water use. Other uses of water, such as during road construction, would be short term and negligible. Although replacement and relocation of housing has the potential to increase water use at that location, the likelihood of that potential is currently unknown because housing would accommodate the same number of staff and would shift existing water use from one location to another. Impacts, if likely, would be described as part of a site-specific EA once designs are complete. It is unknown if climate shifts will affect the availability of water.

## Threatened and Endangered Plants

The ESA requires an evaluation of impacts from federal projects on all federally listed rare, threatened, and endangered plant species. During surveys conducted for the Stehekin Valley Road Improvement Project, two federally listed plant species were identified by the USFWS as potentially being present within the project area. These species included: showy stickseed (*Hackelia venusta*) and Wenatchee Mountains checker-mallow (*Sidalcea oregana* var. *calva*). A NPS plant survey conducted on May 19, 2004, revealed no sensitive plant species along the Stehekin Valley Road, and neither showy stickseed nor Wenatchee Mountain checker-mallow was found during this survey (Bivin pers. comm. 2004) (Appendix 8: *Vascular Plants Observed within Proposed Project Areas*). During initial surveys for these species, conducted during key life stages for the plants, none were found either in the proposed project areas or within the lands proposed for exchange under any of the alternatives. Because additional site-specific surveys would be conducted for these plants prior to actual implementation of project actions, where warranted, and because project actions would then be modified to avoid any plants found, no impacts to special status species would occur.

## Traditional Cultural (Ethnographic) Resources

NPS *Management Policies 2006* (NPS 2006a) and the NPS Cultural Resource Management Guideline (*Director's Order 28* and handbook) (NPS 1998a) direct parks to consider potential impacts of planned actions on cultural resources, including ethnographic resources. Lake Chelan NRA and the surrounding area have a history of habitation and resource use by prehistoric and contemporary American Indians. Analysis of impacts to known resources is important under the NHPA and other laws, including the Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, and Executive Order 13007: Indian Sacred Sites. The NPS defines American Indian traditional cultural (ethnographic) resources as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS 2006a). Traditional cultural properties are ethnographic resources listed on or eligible for the National Register of Historic Places. Pursuant to the Lake Chelan Historic Properties and Cultural Resources Management Plan (FERC Project No. 637), the Confederated Tribes of the Colville Reservation (in a draft TCP plan) have listed three potential TCPs (a plant resource area, a hunting area, and a trail over the Cascade Divide into the Skagit River Valley). Detailed documentation of these is pending, however, there is currently insufficient information to assess potential impacts. Rock art sites are also considered to have TCP significance, however, there are no rock art sites in the area of potential effects (APE) for the SRCIP. It is known that several tribes traditionally used the Stehekin River valley for hunting, gathering, camping and travel and that Lake Chelan NRA holds many resources important to tribes, such as archeological sites, wildlife, plants, and water. Based on documentation of potential TCPs and ethnographic resources, the NPS will continue to work to determine potential effects in consultation with the Colville and Yakama tribal governments. There are currently no impacts to known ethnographic resources from the implementation of Alternatives 1 - 5.

## American Indian Religious Freedom Act

To comply with the American Indian Religious Freedom Act, federal agencies must consider the effects of their actions on American Indian traditional religious practices. Based on analysis in the

APE, there are no known traditional or religious use areas within the proposed project area. In addition, there are no known Indian sacred sites that would require compliance with Executive Order 13007: Indian Sacred Sites (61 FR 26771, 42 USC 1996).

## Museum Collections

*Management Policies 2006* (NPS 2006a) and other cultural resources laws identify the need to evaluate effects on NPS collections, if applicable. Requirements for proper management of museum objects are defined in 36 CFR 79. The North Cascades NPS Complex museum collection is comprised of specimens and objects that document the natural and cultural resources of the park. Much of the collection is the result of research projects within the complex (including artifacts from the mines, sawmills, and other pioneering enterprises of the region) and prehistoric site surveys and excavations. Field notes, photographs, maps, and other resource management records are integral parts of the collection. The museum collection also includes materials from San Juan Island National Historical Park and from Ebey's Landing National Historic Reserve. It is distributed among four different repository sites (Marblemount Curation Facility, Burke Museum, Fort Vancouver, and University of Idaho) and consists of over 2.3 million objects. These collections, including those from Lake Chelan NRA, would not be affected by the proposed project, except by the potential addition of material to the collections if any is found (see mitigation measures under "12. Cultural Resources: Archeological Resources" in the "Environmental Consequences" section).

## Wilderness

NPS wilderness management policies are based on provisions of the 1916 NPS Organic Act, the Wilderness Act (1964), and legislation establishing individual units of the national park system. These policies establish consistent NPS-wide direction for the preservation, management, and use of wilderness and prohibit the construction of roads, buildings, and other man-made improvements and the use of mechanized transportation in wilderness. All park management activities proposed within wilderness are subject to review following the minimum requirement concept and decision guidelines. The public purpose of wilderness in national parks includes the preservation of wilderness character and wilderness resources in an unimpaired condition, as well as for the purposes of recreational, scenic, scientific, education, conservation, and historical use.

The Washington Park Wilderness Act of 1988 (Public Law 100-668) designated 639,840 acres, or 93 percent, of the North Cascades NPS Complex as the Stephen Mather Wilderness. The Stephen Mather Wilderness is connected to a number of other USFS wilderness areas, including the Mount Baker, Pasayten, Noisy-Diosbud, Glacier Peak, Lake Chelan-Sawtooth, and Henry M. Jackson wilderness areas.

Beginning at High Bridge, the Stehekin Valley Road bisects the Stephen Mather Wilderness. The wilderness boundary is 50 feet from the centerline of the road as it existed at the time of the Washington Park Wilderness Act. The wilderness boundary is generally at the 1,640-foot elevation contour.

The wilderness, however, does not include the Stehekin Valley Road, but essentially surrounds the road and the area immediately adjacent to the road. Therefore there would be no direct impacts on the wilderness. Indirect effects on visitor experience within the wilderness, however, may result from construction noise or views of construction activity. Several trails, including the Rainbow Loop Trail, are located within wilderness, close to the road. Use of this trail and other areas within wilderness near the road may be affected by construction noise or views of construction activity. The proposed Lower Valley Trail would be constructed outside of wilderness. Since the project does not directly affect wilderness, and the impacts of construction on the wilderness experience would be short term negligible and localized, this topic was dismissed from further discussion.

## Lightscapes

*Management Policies 2006* (NPS 2006a) states that "the Service will preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light." The stars, planets, and moon, visible during clear nights, influence people and many other species of animals, such as birds terrestrial predators and prey. The proposed actions under the alternatives described in this document would not introduce or increase artificial light sources in the environment beyond current or historic levels and would preserve the ability to see natural features visible on clear nights. Lights that would be part of the relocated maintenance / housing complex would replace lighting now on these existing facilities. New lighting would be directed inward and downward and would be an improvement over existing conditions at current facilities.

## Soundscapes

Park soundscape resources encompass all the natural sounds that occur in parks, including the physical capacity for transmitting those natural sounds and the interrelationship among natural sounds of different frequencies and volumes in the park (NPS 2006a). NPS *Director's Order 47* (Sound Preservation and Noise Management) (NPS 2000) defines operational policies that will protect, maintain, or restore the natural soundscape. Natural sounds are part of the park environment and are vital to the functioning of ecosystems and may also be valuable indicators of their health. Soundscape is the total ambient acoustic environment associated with an area. It may be composed of both natural and human-made sounds. In a high noise environment, natural ambient sounds may be masked by other noise sources. Natural quiet is another term for characterizing the expected natural soundscape.

Construction activities associated with the alternatives under consideration, such as excavation, clearing and grading, earth hauling, gravel spreading, and operation of construction equipment and vehicles, would generate the primary sources of noise from the project (changes in operations are not expected to have an appreciable effect on existing noise levels, since the project would not result in an increase in traffic volumes or new uses). Construction noise impacts would largely be short term, localized, and minor for the public. Although there is a potential for some impacts to visitors or wildlife, mitigation measures would be used to minimize these impacts. Mitigation measures that would be used include avoiding construction during the breeding and nesting period of threatened and endangered bird species, and the following general construction Best Management Practices (BMPs):

- Construction equipment would be located as far as possible from sensitive receptors such as wildlife, visitors, and residents.
- Equipment would not be left idling when not in use.

- Mufflers would be used on all equipment.
- Only well-maintained and properly functioning equipment would be used.

Since impacts would be short term, localized, and mitigation would be used to further reduce or limit impacts, soundscape impacts were dismissed. Noise impacts, however, are addressed in the "Wildlife, Threatened, and Endangered Species" and "Visitor Experience" sections. There would be a negligible long-term increase in noise (intermittent) from rerouting the road under Alternatives 2, 3, and 5 and a similar decrease in the area it was rerouted away from. No other long-term noise impacts would occur; therefore, this topic has been dismissed from additional consideration.

## Prime and Unique Farmlands

The Farmland Protection Policy Act was implemented to preserve and protect the dwindling supply of farmland in the nation. In 1980, the CEQ directed that federal agencies assess the effects of their actions on farmlands classified by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service as prime or unique. The USDA defines these lands as having soils that are best suited for producing food, feed, forage, and fiber or oilseed crops. The alluvial river soils in the Stehekin River Valley are classified as prime farmland soils, but not unique soils. Use of land for farming and the type of farmland soils are considered in determining prime and unique farmland. There is not much current use of the land in the Stehekin Valley for farming, except for some pasture and small vegetable gardens. Historically, however, farming was associated with homesteads, including the Buckner Homestead hayfield and pasture. The alternatives would not affect the use of land for farming.

The alternatives under consideration would not have an appreciable effect on prime farm soils for several reasons:

- The road alignment would remain similar. Although there would be some road widening for pullouts in places, there would be little additional loss of farmland soils caused by this work. Topsoil would be removed to locate road base materials and then pulled back over the surface of the road.
- Under the road reroute alternatives, the topsoil would also be preserved and would be used to rehabilitate the old alignments, saving farmland soils.
- The amount of farmland soil loss compared with the total area of these soils within the valley is very small (less than one percent).

Therefore, this impact topic was dismissed from further analysis.

## Energy Consumption

Implementation of the proposed actions would not cause measurable increases in the overall consumption of electricity, propane, wood, fuel oil, gas, or diesel associated with visitation or for park operations and maintenance. A measureable decrease, however, is expected to be achieved with the construction of the new maintenance facility.

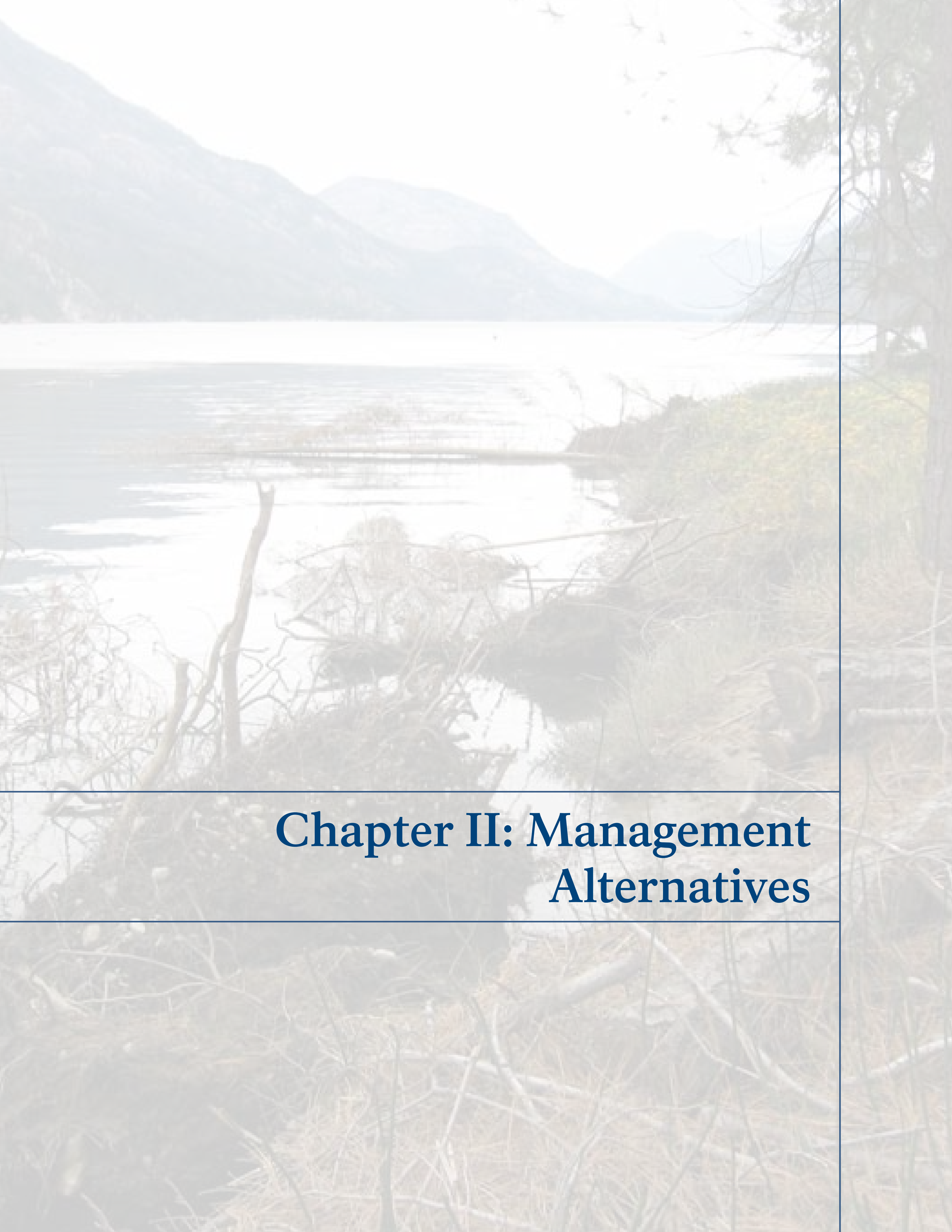
## Climate Change

Climate change has been dismissed as an impact topic for two reasons. First, none of the actions proposed in this plan would measurably contribute to greenhouse gas emissions that would affect climate change. While the carbon footprint is calculated for each alternative in Appendix 19 and discussed in Chapter 4 (Air Quality Impacts), the size of the carbon footprint and the differences between alternatives is small.

Climate change is also dismissed as an impact topic because all alternatives presented in this EIS are designed to address climate change impacts that have already occurred – a seasonal shift in flooding that has brought larger, more frequent floods (Figure I-7). The University of Washington Climate Impacts Group has modeled the impact of future climate warming on the Stehekin River, and the output from this analysis supports the inference that climate change has already affected the region's hydrology (REF). The analysis of the alternatives considers how these changes would influence the project area. Therefore, additional analysis of climate change impacts on the hydrology of the Stehekin River would not change the range of alternatives in this plan.

## Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations (59 FR 7629, as amended by Executive Order 12948, 60 FR 6381, 42 USC 4321), requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse levels of human health or environmental effects from their programs and policies on minorities and low-income populations and communities. This executive order does not apply to the subject of this document. The actions evaluated in this document would not have an effect (either beneficial or adverse) on socially or economically disadvantaged populations. According to the 2010 census data, no members of the Stehekin Community identified themselves as living below the poverty level, and there are no other indicators that disadvantaged persons live in the area or would be disproportionately affected.



# Chapter II: Management Alternatives

**Bank Erosion at Weaver Point.**

# CHAPTER II: MANAGEMENT ALTERNATIVES

This chapter describes the proposed alternatives including the reasons for dismissing options that do not meet project objectives or other defined criteria. The Alternative Comparison Chart (Table II-1) highlights the major differences among the alternatives. This chapter also identifies and provides analysis related to the selection of the environmentally preferable alternative and describes how the alternatives meet the purpose and need.

This chapter is divided into the following sections:

- Section A: Introduction (containing a brief description of each alternative)
- Section B: Actions Common to All Alternatives (1 - 5)
- Section C: Detailed Description of Differences Among Alternatives 1 - 5
- Section D: Alternatives and Actions Considered but Dismissed
- Section E: Mitigation Measures (see the detailed list of these in Chapter IV: *Environmental Consequences* and Appendix 6: *Summary of Mitigation Measures*)
- Section F: Environmentally Preferable Alternative (the alternative with the most benefits and fewest impacts, defined according to Council on Environmental Quality (CEQ) criteria).
- Section G: Consistency of Alternatives with Purpose and Need

## A. INTRODUCTION

The alternatives were developed from collaborative interdisciplinary analysis based on the expertise of planning team members from the National Park Service (NPS) and Federal Highway Administration (FHWA) as well as from internal and external scoping with the Stehekin Community; federal, state, and local agencies, including Chelan County; Native American Indian Tribes; and interested organizations and individuals. The technical merit of alternative concepts and actions was reviewed by an interagency committee, comprised of state, federal, and county officials. Representatives included the Washington Department of Ecology, Washington Department of Fish and Wildlife, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Chelan County, Chelan County Public Utility District (Chelan PUD), and Geomax PC.

Five alternatives are included:

- Alternative 1 (No Action): Continue Current Management Practices and Existing Plan Implementation);
- Alternative 2: At-Risk Public Facilities Removed from Channel Migration Zone Where Possible; More Priority Land Exchange/Acquisition in Channel Migration Zone;
- Alternative 3: At-Risk Public Facilities Removed from Channel Migration Zone in Most Areas; Same Land Protection Plan as Alternative 2;

- Alternative 4: At-Risk Public Facilities Removed from Channel Migration Zone in Some Areas; Less Priority Land Exchange / Acquisition in Channel Migration Zone; and
- Alternative 5: At-Risk Public Facilities Removed from Channel Migration Zone Where Possible; Priority Land Exchange/Acquisition in Most Vulnerable Areas (NPS Preferred).

The differences among the alternatives are primarily related to different management actions at the same sites (see Table II-1: *Alternative Comparison Chart*).

All action alternatives are based upon the concept of floodplain utilization to varying degrees. Floodplain utilization is embraced in this plan as the best approach for managing a flood-prone mountain river -- particularly one prone to large fall floods. This concept allows floodwaters to occupy the floodplain to achieve the benefits of slower, shallower floodwater for all areas and is a long-term sustainable approach. Under floodplain utilization, rivers are not constrained by dikes or levees, but rather are allowed to spread out across the floodplain to reduce flood damage in any one area during the largest events.

For public land, all action alternatives attempt to avoid the channel migration zone (CMZ), rather than only the 100-year floodplain. The CMZ is defined as the area where the Stehekin River has migrated in the past 1,000 years. The reasons for using this more conservative approach include observed rapid changes in floodplain boundaries during large floods, the high cost of using computer models to determine flood elevations, and the inaccuracy of the models.

Consistent with past public-private partnerships on both sides of the river at McGregor Meadows and elsewhere in the valley, this plan identifies new management strategies in partnership with private landowners where public and private concerns overlap.

The management alternatives also attempt to develop sustainable linked public-private actions. Past integrated actions undertaken by the NPS include public-private partnerships to maintain floodplain utilization in McGregor Meadows (1998), the "1948" channel (2007), and upper Company Creek Road (2007). In this plan, integrated solutions to erosion and floodplain utilization include the proposed actions at Boulder Creek and the Stehekin River Mouth, and using the Land Protection Plan (LPP) revision to protect the most vulnerable locations in the CMZ.

The alternatives conform to Lake Chelan NRA policies in the Lake Chelan General Management Plan (GMP), which call for removing public and administrative facilities from the floodplain. Options for private development in the floodplain include exchange of land with the NPS, purchase of private property out of the floodplain, elevating cabins, or construction of a variety of physical features to reduce the impacts of flooding. Other alternatives, such as construction of additional levees or dikes or dredging were considered and dismissed because they run counter to the concept of floodplain utilization. They would thereby have unacceptable impacts on the ecology of the Stehekin River floodplain and would require repeated, costly management actions (see "D. Alternatives and Actions Considered but Dismissed" and Appendix 18: *Estimates of Gravel Accumulation in Two Reaches of the Stehekin River*).

Alternatives 1 - 4 were described in the SRCIP DEIS. Alternative 5 is a modification of Alternative 2 based on public comments on the DEIS. It incorporates changes suggested by these public comments, including providing access to McGregor Meadows from the proposed reroute as part of plan actions now, rather than later, when existing access is damaged. The existing access road and some driveways would be reinforced in Alternative 5. It also responds to comments on Land

**Table II-1: Alternative Comparison Chart**

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| FOCUS | | | | | |
| **Management concept / working title** | Continue Current Management Practices and Existing Plan Implementation. | At Risk Public Facilities Removed From Channel Migration Zone (CMZ) Where Possible; More Priority Land Exchange/ Acquisition in CMZ. | At Risk Public Facilities Removed From Channel Migration Zone in Most Areas; Same Land Protection Plan as Alternative 2. | At Risk Public Facilities Removed From Channel Migration Zone in Some Areas; Less Priority Land Exchange/Acquisition in the CMZ. | At Risk Public Facilities Removed from Channel Migration Zone Where Possible; Priority Land Exchange/Acquisition in Most Vulnerable Areas. |
| **Floodplain and land use concept**<br>*(continued on next page)* | Large floods would continue to be constricted by development in the floodplain.<br>The Stehekin Valley Road would be retained in its current alignment, with the grade raised in parts of McGregor Meadows. Because of the road grade raise, water from large floods would be restricted from some of the floodplain.<br>NPS administrative facilities would be moved out of the floodplain, causing minor changes in the current pattern of development. | Large floods could occupy more of the floodplain.<br>NPS administrative facilities that could affect the river system would be removed from the floodplain. Private development in the floodplain would be relocated through long-term actions proposed by the revision of the LPP. Private development not relocated could be flood-proofed or could eventually be affected by flooding. The LPP has been revised to respond to private property owners in greatest danger of flood impacts. | Large floods could occupy most of the floodplain (less than Alternative 2).<br>The Stehekin Valley Road would be similar to Alternative 2 except that only the McGregor Meadows portion would be rerouted.<br>Erosion protection measures would be implemented at five sites (including the same sites in Alternative 2 plus Lower Field and Weaver Point).<br>NPS administrative facilities would be moved out of the floodplain. | The Stehekin River would be restricted from part of its floodplain at McGregor Meadows.<br>Most development would remain in floodplain. As in Alternative 1, there would be the potential for new private development in floodplain.<br>The Stehekin Valley Road would be retained in its current alignment, with bank hardening at several sites and raising the road grade through McGregor Meadows. | Same as Alternative 2. |

| | Alternative 1 No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 Preferred |
|---|---|---|---|---|---|
| **Floodplain and land use concept** *(continued from previous page)* | There would continue to be potential for new development to occur within the CMZ.<br>Erosion protection measures would be implemented at one site, but could eventually be needed at the same sites described in Alternative 4. | A major reroute of the Stehekin Valley Road would occur around the floodplain at McGregor Meadows. Erosion protection measures would be implemented at three sites (near the Stehekin River mouth, Frog Island, and Wilson Creek).<br>NPS administrative facilities would be moved out of the floodplain. | | Erosion protection measures would be implemented at seven sites, including those identified in Alternative 3, plus at Milepost 7.0 and 9.2.<br>NPS administrative facilities would be moved out of the floodplain. | |
| **Land acquisition and exchange concept / LPP** *(continued on next page)* | The NPS would continue to implement the existing 1995 LPP to remove private development from the floodplain and to protect natural, cultural and scenic resources.<br>As properties with improvements are acquired or exchanged, buildings and infrastructure would be removed and the sites restored to natural conditions. | Under the 2010 revision to the 1995 LPP, the NPS would encourage private landowners to relocate from within the floodplain / channel migration zone to outside of it using management actions such as exchange or acquisition from willing sellers.<br>The 1995 LPP has been revised to identify new priorities for acquisition and exchange based on nine criteria weighted more toward river protection than scenic qualities. | Same as Alternative 2. | Under the revision to the 1995 LPP, the NPS would acquire land through exchange and purchase from willing sellers to remove private development from the channel migration zone.<br>The 1995 LPP has been revised to identify new priorities for acquisition and exchange based on nine criteria weighted less toward river protection and more toward retaining the Stehekin Valley Road in its current alignment than in Alternatives 2 and 3. | Similar to Alternative 2, except that the 1995 LPP has been revised to identify priorities for acquisition and exchange based on eight criteria (including a criterion for visual sensitivity) weighted more toward protecting the most vulnerable areas, particularly the McGregor Meadows deposition zone. Criteria to protect scenic qualities at the head of the Lake would also be included. |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **Land acquisition and exchange concept / LPP**<br>*(continued from previous page)* | | More priority sites have been identified for acquisition / exchange from willing sellers in the channel migration zone so more structures / infrastructure (including buildings, septic systems, and power lines) would be removed than in Alternative 1. | | As properties with improvements are acquired or exchanged, buildings and infrastructure would be removed and the sites restored to natural conditions. | |
| **Response to flooding and erosion** | As needed, the NPS would continue case-by-case response to flood-related damage affecting public facilities.<br>Private landowners with development in the channel migration zone would continue to be responsible to self-implement flood protection measures. No actions would be undertaken by NPS to prevent private property from flooding.<br>The Stehekin Valley Road through McGregor Meadows would be elevated, but prone to erosion/scour damage. | Actions would be similar to Alternative 1; however, the NPS would relocate roads and administrative facilities out of channel migration zone, proactively anticipating effects from future flooding. | Same as Alternative 2. | Same as Alternative 1.<br>Road through McGregor Meadows would be elevated, but prone to erosion / scour damage.<br>As in Alternatives 2 and 3, the NPS would relocate administrative facilities out of the channel migration zone, proactively anticipating effects from future flooding. | Same as Alternative 2 plus: four grade control structures (1,000 linear feet) could be added across the Stehekin Valley Road / driveways in the lower McGregor Meadows area. |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| MANAGEMENT ACTIONS | | | | | |
| **Roads** | | | | | |
| **Stehekin Valley Road: Reroutes** | **Reroutes**<br>None.<br>Road grade raise at Milepost 6.25 to 6.53. Road grade raise of one to four feet at Milepost 6.95 to 7.14. Approximately 5,600 cubic yards of fill would be used.<br>Slight realignment and slope work at Milepost 6.0 to 6.5.<br>**Lower Field Riparian Restoration**<br>Riparian restoration would occur along the bank to the edge of the existing roadway adjacent to the Lower Field. | **Reroutes**<br>McGregor Meadows and Lower Field.<br>**McGregor Meadows Reroute Actions**<br>Remove and restore Stehekin Valley Road above Milepost 6.5 but maintain grade control structures at Milepost 7.0 until infeasible based on river conditions or not needed (see below).<br>The reroute would be from Milepost 5.7 to 7.5.<br>**Lower Field Reroute Actions**<br>Remove existing road at Lower Field, restore road alignment and implement riparian restoration, while retaining the agricultural area and a portion of the road as the Lower Valley Trail. | **Reroutes**<br>McGregor Meadows.<br>**McGregor Meadows Reroute Actions**<br>Same as Alternative 2 except a slightly shorter reroute from Milepost 5.7 to 7.3 since the portion of the existing road that borders Lower Field would be stabilized with riparian vegetation and rock barbs.<br>**Lower Field Riparian Restoration**<br>Same as Alternative 1, plus:<br>Install two rock barbs and bioengineering to protect road in current location along Lower Field. | **Reroutes**<br>Same as Alternative 1.<br>**Lower Field Riparian Restoration**<br>Same as Alternative 3. | **Reroutes**<br>McGregor Meadows, and Lower Field.<br>Reroute Access Road<br>**McGregor Meadows Reroute Actions**<br>Same as Alternative 2 plus a mechanically stabilized earth (MSE) wall would be constructed to reduce cut and fill needs.<br>**Reroute Access Connector**<br>Beginning above NPS Tract 07-201construct a 940 - 1,200 feet long, 12-feet wide connector to the McGregor Meadows Access Road (Stehekin Valley Road).<br>**Lower Field Reroute Actions**<br>Same as Alternative 2. |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **McGregor Meadows Access Road** | N/A | Approximately 0.8 miles of the existing road would be maintained until it is either no longer needed or if it is severely damaged by flooding and infeasible to restore. This access road could be impassible during peak flood events.<br>Approximately 0.7 miles of abandoned road would be revegetated to accommodate a trail.<br>Designate a small parking area (turnaround) at Milepost 6.5. | Same as Alternative 2 except: Approximately 0.5 miles of abandoned road would be restored. | N/A | Same as Alternative 2. |
| **Stehekin Valley Road private access** | Private access would be via existing spur roads off the Stehekin Valley Road.<br>Private access would be limited during flooding. (Grade raises would not raise the height of the road above projected flood levels.)<br>Access would be maintained where the road grade is raised in McGregor Meadows. | Same as Alternative 1 plus:<br>Private access would be maintained in areas bypassed by the Stehekin Valley Road realignment.<br>Develop criteria to maintain reasonable private access across federal property as warranted. | Same as Alternative 2 | Same as Alternative 1 plus:<br>Develop criteria to maintain reasonable private access across federal property as warranted. | Same as Alternative 2 plus:<br>A 940 - 1,200 foot long Reroute Access Connector would be constructed to provide access to McGregor Meadows. |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **Company Creek road protection strategy / erosion protection measures** | Maintain road in its existing alignment consistent with GMP.<br>Maintain the existing levee and existing erosion protection measures (barbs and grade control structures). | | | | |
| **Harlequin Bridge** | Continue to maintain. If replacement is needed, recommend a longer span bridge. | | | | |
| **Administrative Facilities*** | | | | | |
| **Maintenance Area** | Implement the GMP to relocate the maintenance area to the north end of the airstrip. Restore riparian and upland area at vacated site. | | | | |
| **NPS Housing**<br>*(continued on next page)* | Implement the GMP to construct new and replacement NPS housing at the north end of the airstrip in conjunction with the new maintenance area. Remove three houses located in the channel migration zone along the Company Creek Road (NPS Tracts 06-118, 06-104, 06-121 and 06-122). Expanded housing would be for operations.<br>Existing housing, currently subject to flooding in the channel migration zone, would be removed and sites restored by removing | Same as Alternative 1. | Same as Alternative 1. | Same as Alternative 1. | Same as Alternative 1 except that replacement NPS housing could also be located in other sustainable places within the lower Stehekin Valley. |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **NPS Housing**<br>*(continued from previous page)* | infrastructure, including buildings, septic systems and powerlines. | | | | |
| **Recreational Facilities** | | | | | |
| **Weaver Point Cultural Resources** | Continue to maintain Weaver Point Campground in its existing location and implement GMP and Chelan PUD recommendations to relocate campsites affected by shoreline and bank erosion to the east of the docks.<br>Implement proposed Federal Energy Regulatory Commission (FERC) logjam. Relocate docks to the west, away from the river when lake is drawn down. | Same as Alternative 1 plus:<br>Coordinate with proposed FERC projects to protect Weaver Point cultural resources. | Same as Alternative 1 plus:<br>Extend proposed FERC logjam up-river, and install two rock barbs and bioengineering to prevent river shoreline erosion and protect Weaver Point Campground.<br>Coordinate with proposed FERC projects to protect Weaver Point cultural resources. | Same as Alternative 2. | Same as Alternative 2. |
| **Harlequin Campground** | Maintain Harlequin Campground, including group sites, in its existing location. Take actions as needed in response to flooding.<br>Continue to use Harlequin Campground except during flooding and unless catastrophic impacts occur. | Same as Alternative 1 except:<br>Harlequin Campground group site would be seasonally closed during anticipated flooding in spring and fall. | | | |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **Purple Point Horse Camp** | Purple Point Horse Camp would continue to be used for horse parties plus as an overflow group campsite. | Construct additional group/individual campsites at Purple Point Horse Camp to replace seasonally flooded group site at Harlequin. New campsites would include corresponding infrastructure. | | | |
| **Rainbow Falls Campground (proposed)** | N/A | Construct three to four new individual campsites near Rainbow Falls. Campsites would include corresponding infrastructure and would make use of existing infrastructures, such as the toilet and access road. | | | |
| **Company Creek Campground (proposed)** | N/A | N/A | Construct new campsites along lower Company Creek below Power Plant. Campsites would include corresponding infrastructure. | | N/A |
| **Bullion Campground** | Relocate Bullion Campground across the road to avoid hazard trees. Allow day use at existing site. Add vault toilet. New campsites would include corresponding infrastructure. | | | | |
| **Lower Valley Trail** | Implement the GMP recommendation for a Lower Valley Trail (hiker/equestrian) to connect the High Bridge area with Stehekin Landing. Trail alignment would follow segments of the historic road and use 6.1 miles existing trail and build 6.3 miles of new trail. | Alignment for trail would be on the old Stehekin Valley Road where realignments occurred around McGregor Meadows and Lower Field and would take advantage of 7.9 miles of existing trail and road, including some segments of the historic road. It would require 4.6 miles of new trail. | Same as Alternative 2 except alignment would not be along Lower Field. | As in Alternative 1, trail alignment would follow more segments of the historic road. | Similar to Alternative 2, except that the trail would go in front of, rather than behind the Stehekin Valley Ranch, and the historic access road to Buckner Orchard would be converted to a trail.<br><br>Bicycle use would also be allowed on the decommissioned portion of the Stehekin Valley Road (from the McGregor Meadows Access Road and area above Milepost 6.5 to the Lower Field). |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **Stehekin River Trail connector to Lower Valley Trail** | Implement the GMP recommendation to add a bridge crossing at the former bridge site above Boulder Creek to connect the proposed Lower Valley Trail with the Stehekin River Trail. | | | | |
| **River Access Points** | Retain the existing raft launch near Bullion Campground. | Same as Alternative 1 plus:<br>Construct new river access point near the Stehekin River Mouth and add new 300-foot long spur road off Stehekin Valley Road. Coordinate actions with private landowners. | Same as Alternative 1. | Same as Alternative 2. | Same as Alternative 2. |
| **Shooting Range** | Retain shooting range in its existing location. | In conjunction with the Lower Field Reroute, remove the shooting range, rehabilitate potential contamination and restore the abandoned site. | Same as Alternative 1. | | Same as Alternative 2 |
| **Management of Large Woody Debris** | | | | | |
| **NPS Actions**<br>*(continued on next page)* | Continue to Implement GMP Guidance and to salvage floating logs from the head of Lake Chelan.<br>Limited actions could continue to be taken to trim or turn individual large pieces for the | Same as Alternative 1 plus:<br>Logjam manipulation could occur in the Lake Chelan backwater zone from the head of Lake Chelan to Boulder Creek. A logjam in this area could also be | Same as Alternative 2. | Same as Alternative 2 except:<br>Logjam manipulation could occur anywhere along the Stehekin River below Bullion Raft Launch for same purposes as in Alternatives 1 and 2. | Same as Alternative 2. |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **NPS Actions**<br>*(continued from previous page)* | purpose of enabling recreational opportunities and to protect roads and bridges.<br>The NPS would seek to acquire through purchase or exchange properties that could be threatened by large woody debris jams so as to preclude manipulation of large woody debris in the system.<br>(There would continue to be no use of logs from logjams for erosion protection measures.) | manipulated under emergency conditions if it flooded the Stehekin Valley Road or caused flooding of densely developed areas and threatened water quality.<br>Manipulation of logjams would be the minimum needed to relieve threats from shoreline erosion to public roads, water quality, public safety, and regular access to private property.<br>Use of LWD from logjams for bank stabilization and restoration would be limited to single pieces on top of logjams above the ordinary high water mark that would not destabilize the jam.<br>In all actions wood remains within the channel migration zone, and would be used only for erosion protection measures or restoration. | | | |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **Private Use** | Continue to Implement GMP Guidance. | Same as Alternative 1 plus:<br>Woody debris from the tops of logjams or from Lake Chelan salvage (according to the criteria above) could be made available to private landowners from NPS stockpile for bank stabilization and restoration provided applicable permits are obtained. | Same as Alternative 2. | Same as Alternative 2 plus:<br>Use of logs from the tops of some logjams would extend from Lake Chelan to Bullion. | Same as Alternative 2. |
| **Sourcing of rock for erosion protection and road** | The NPS would continue to honor limitations on rock procurement within Lake Chelan NRA from GMP and *Sand, Rock, and Gravel Plan*. Large angular rock would continue to be barged in for rock barbs. Material from the Company Creek Pit that has been determined to be excess to Lake Chelan needs (oversize and some screened material) could also be used. | | | | |
| **Flood Protection Measures** | | | | | |
| **Public facilities / private development**<br>*(continued on next page)* | The NPS would continue to respond to periodic flooding events as they occurred, installing bank protection devices, or relocating sections of former roadway as needed, subject to individual project-by-project environmental analysis.<br>Maintain integrated grade-control structures in McGregor Meadows | Actions would be similar to Alternative 1, except that NPS response to flooding would be proactive and a revised LPP would place a higher priority on private land in the channel migration zone to avoid impacts from flooding by exchanging properties in the channel migration zone for properties outside of it. | Same as Alternative 2. | Actions would be the same as Alternatives 2 and 3 except that less private development would remain within the channel migration zone because land exchanges would emphasize retaining the Stehekin Valley Road more than allowing the river to migrate within the channel migration zone. | Actions would be similar to Alternative 2, except that there would be a focus on minimizing the amount of private development by exchanging properties in the most vulnerable areas (deposition zones) for properties outside of these areas. |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **Public facilities / private development**<br>*(continued from previous page)* | and upper Company Creek Road under existing agreements.<br>Continue to maintain road surfaces after flood damage.<br>Encourage Chelan PUD to keep Lake Chelan level as low as possible during spring and fall flood seasons.<br>Work with Chelan County to require raised drain fields for new construction and modification of existing drain fields that frequently flood.<br>Provide Stehekin Valley landowners with technical support for using ACOE recommended Advance Protection Measures on private property.<br>Maintain Company Creek levee.<br>NPS maintenance and housing would be removed. from the channel migration zone to avoid impacts from flooding. | | | | |

| | Alternative 1 No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 Preferred |
|---|---|---|---|---|---|
| **Erosion Protection Measures** | | | | | |
| **Proposed number of barbs** | Unknown number of new rock barbs | Six to eight new rock barbs | Four new rock barbs | 16 - 17 new rock barbs | Same as Alternative 2. |
| **Logjams** | None | Two new logjams | Five new logjams | Three new logjams | Same as Alternative 2 |
| **Company Creek Road and Stehekin Valley Road** | Maintain erosion protection measures (rock barbs and grade control structures) installed by the NPS since the 1980s on Company Creek Road and those installed since the 1930s by the NPS along the Stehekin Valley Road. | | | | Same as Alternatives 1 - 4, plus install 4 new grade control structures in McGregor Meadows. |
| **Weaver Point** | See Weaver Point Campground above. | | | | |
| **Stehekin River Mouth** | Except under emergency conditions, no action would be taken by NPS to prevent the Stehekin River from eroding or overtopping the left (northeast) bank on NPS land above the Stehekin River mouth. | Replace approximately 100 feet of rip-rap on public land with three rock barbs and bioengineering and construct small logjam to minimize potential for a river channel shift. | Replace rip-rap with engineered logjam (new river access point) to slow bank erosion. | Same as Alternative 2. | Same as Alternative 2. |
| **Stehekin Valley Road Erosion Protection Measures and Floodplain Restoration** | | | | | |
| **1. SVR Milepost 2.0 (Boulder Creek Area)** | The NPS would repair the Stehekin Valley Road near bakery as needed after flood damage. | Same as Alternative 1 plus: construct a logjam atop a grade control structure (avulsion sill) away from the bank of the river and back into the forest to the Boulder Creek alluvial fan to slow floodwater and maintain sheet flow of water over bank. | | | |
| **2. Buckner Homestead Hayfield and Pasture** | N/A | Plant native vegetation in riparian area and use large woody debris to slow bank erosion. | | | |
| **3. SVR Milepost 3.8 (Frog Island)** | N/A | Stabilize bank with one to two barbs and bioengineering within 30 feet of the road. | Construct an engineered logjam and use bioengineering to stabilize the bank adjacent to the road. | Same as Alternative 2. | |

| | Alternative 1 No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 Preferred |
|---|---|---|---|---|---|
| **4. SVR Milepost 5.1 (Skinny Wilson)** | N/A | | | | Forty feet of road shoulder would be stabilized by constructing a rock wall to replace decomposing logs that currently support the road shoulder across from the former Skinny Wilson property. |
| **5. SVR Milepost 5.3 (Wilson Creek)** | Install clusters of rip-rap near the toe of the slope and log cribbing in the mid-slope area.<br>Regrade slope for approximately 400 feet, lower roadbed ten feet, and move road laterally 15 feet into the hillside. Install two new 60-inch culverts and a new ditch. If the road becomes undermined, rebuild the road in place. Purchase land or easement to access site.<br>If the need for additional erosion protection impacts private property at Milepost 5.5 to implement work at Wilson Creek, work with the landowner to identify mitigation and/or compensation for impacts. | Same as Alternative 1 except:<br>Instead of rip-rap clusters, construct two to three rock barbs to stabilize the toe of the slope and augment natural bank armoring.<br>The road would be raised up to four feet to improve drainage of Wilson Creek and shifted into the cutslope.<br>An easement or purchase of approximately 1.5 acres would be needed to complete this work. | Same as Alternative 2 except:<br>Instead of rock barbs or rip-rap clusters, install a large logjam at the toe of the slope. | Same as Alternative 2. | |

| | Alternative 1 No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 Preferred |
|---|---|---|---|---|---|
| **6. SVR Milepost 6.25 - 6.53 and Milepost 6.95 - 7.14** | As called for by the Road Improvement Project, raise roadbed one to four feet. | Road would not be raised because the McGregor Meadows Reroute would occur. | Same as Alternative 2. | Same as Alternative 1. | Same as Alternative 2 plus:<br>Four grade control structures could be installed in lower McGregor Meadows to maintain sheet flow, slow avulsion, and to limit the amount of new gravel introduced to river by stream avulsion through McGregor Meadows.<br>The four grade control structures (1,000 linear feet) could be installed beneath three driveways and from the access spur to the Stehekin Valley Road. |
| **7. SVR Milepost 6.0 - 6.5** | As called for by the Road Improvement Project, lay back slope, remove eyebrow, construct drystack rock wall, and implement minor road realignment between Milepost 6.0 - 6.5 to improve sight distance. | Action would not be taken because the road would be rerouted. | | Same as Alternative 1. | Same as Alternatives 2 and 3. |

<table>
<tr><th></th><th>Alternative 1<br>No Action</th><th>Alternative 2</th><th>Alternative 3</th><th>Alternative 4</th><th>Alternative 5<br>Preferred</th></tr>
<tr><td>8. SVR Milepost 7.0</td><td>Continue to maintain grade control structures and reroute constructed as part of earlier implementation of the Road Improvement Project. Repair road following flooding.</td><td>Road would be bypassed by reroute above Milepost 6.5, but the NPS would continue to maintain grade control structures at Milepost 7.0.</td><td>Same as Alternative 2.</td><td>Same as Alternative 1 plus construct two rock barbs to maintain road at Milepost 7.0.</td><td>Same as Alternative 2.</td></tr>
<tr><td>9. SVR Milepost 7.3 - 7.4 Lower Field</td><td>Implement riparian restoration along edge of Lower Field.</td><td>Same as Alternative 1 plus: revegetate the abandoned road section to accommodate a trail.</td><td>Same as Alternative 2 plus:<br>Add two rock barbs and bioengineering to protect Stehekin Valley Road alignment.</td><td>Same as Alternative 3.</td><td>Same as Alternative 2.</td></tr>
<tr><td>10. SVR Milepost 7.8 Thimbleberry Creek</td><td>Retain 72-inch and two 48-inch culverts.</td><td colspan="4">Replace one 72-inch culvert and two 48-inch culverts with two 60-inch culverts.</td></tr>
<tr><td>11. SVR Milepost 8.0</td><td>Continue to maintain armored section of roadway and to monitor slope for stability. If the road becomes undermined, rebuild it in place.</td><td colspan="4">Scale (remove) rocks off the steepest sections of the slope and augment rip-rap along road embankment. A rock wall (100 - 150 feet long and three to eight feet high) would also be added at the base of the slope. Maintain raised section of roadway, including rock barbs and bioengineering. If the road becomes undermined, rebuild it in place.</td></tr>
</table>

| | Alternative 1 No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 Preferred |
|---|---|---|---|---|---|
| **12. SVR Milepost 8.5** | As called for by the Road Improvement Project, realign culvert to meet creek at point of entry rather than forcing it parallel to the road and then under the road. | Elevate the road approximately two feet, install low water concrete plank crossing, and excavate an outlet channel between the low water crossing and the Stehekin River. | | | To improve bicycle access, a concrete box culvert with a removable top would be used instead of a low-water crossing and the road would be raised approximately three to four feet over a distance of 450 feet. As in Alternatives 2 - 4, an outlet channel would be constructed between the culvert and the Stehekin River. The existing 24-inch culvert would be cleaned and retained. |
| **13.SVR Milepost 9.2 (Above Stehekin Valley Ranch)** | As called for by the Road Improvement Project, construct vehicle turnaround and parking area for ten vehicles or five vehicles and one bus.<br>Continue to monitor threats to Stehekin Valley Road and maintain existing grade control structures. | Same as Alternative 1 for vehicle turnaround and parking.<br>Elevate 300 feet of road, install low water concrete plank crossing, and excavate an outlet channel between the low water crossing and the Stehekin River. | | Same as Alternative 2 plus add three rock barbs and bioengineering to protect Stehekin Valley Road. | Same as Alternatives 2 and 3 except that parking area would accommodate a smaller number of vehicles. |

| | Alternative 1<br>No Action | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5<br>Preferred |
|---|---|---|---|---|---|
| **Interpretation and Education** | | | | | |
| | Continue to conduct existing interpretive and educational programs and activities related to the Stehekin River. | Enhance interpretive and educational programs related to natural riverine processes, such as channel migration and the ecological role of large woody debris in rivers. | | | |
| **Research and Monitoring** | | | | | |
| | Continue existing research and monitoring programs, including LWD, main and side channel habitat, hydrology, fish surveys, cultural resources research and analysis, nonnative/invasive plants, climate change effects, special status species research, and other inventory and monitoring work. | Enhance research programs related to the Stehekin River. Among these could include conducting annual water quality monitoring to assess the short- and long-term impacts of management actions on aquatic biological resources in the Stehekin River. | | | |

** These actions would require additional site specific environmental impact analysis and are not analyzed in detail in this document.*

Protection Plan priorities to focus on protecting the most vulnerable areas from flood-related impacts. Alternative 5 also offers a slight realignment of the Lower Valley Trail. Other slight modifications, such as a mechanically stabilized earth (MSE) wall, have been added to further reduce impacts from the proposed reroute. In addition, future proposed administrative housing could also be constructed throughout the lower valley rather than only in conjunction with the relocated maintenance facilities, as described in Alternatives 1-4.

## 1. Summary of Actions Common to All Alternatives (1 - 5)

Several actions in this plan are common to all Alternatives (1 - 5) because they were identified in the GMP. These actions would also protect public facilities or support the concept of floodplain utilization (Figure II-1: *Major Actions Common to All Alternatives*).

Actions called for by the 1995 Lake Chelan National Recreation Area (NRA) GMP that would be implemented by all alternatives include replacement and relocation/construction of the NPS maintenance compound to the north end of the airstrip; replacement and relocation/ construction of administrative housing; creation of a Lower Valley Trail that connects from Stehekin Landing to High Bridge and which is also connected to the Stehekin River Trail via a footbridge; and the ongoing use of willing seller-willing buyer land acquisition and exchange to encourage the removal of unsustainable development from the Stehekin River CMZ. Actions involving the replacement of administrative facilities require additional site specific environmental impact analysis and are not analyzed in detail in this document.

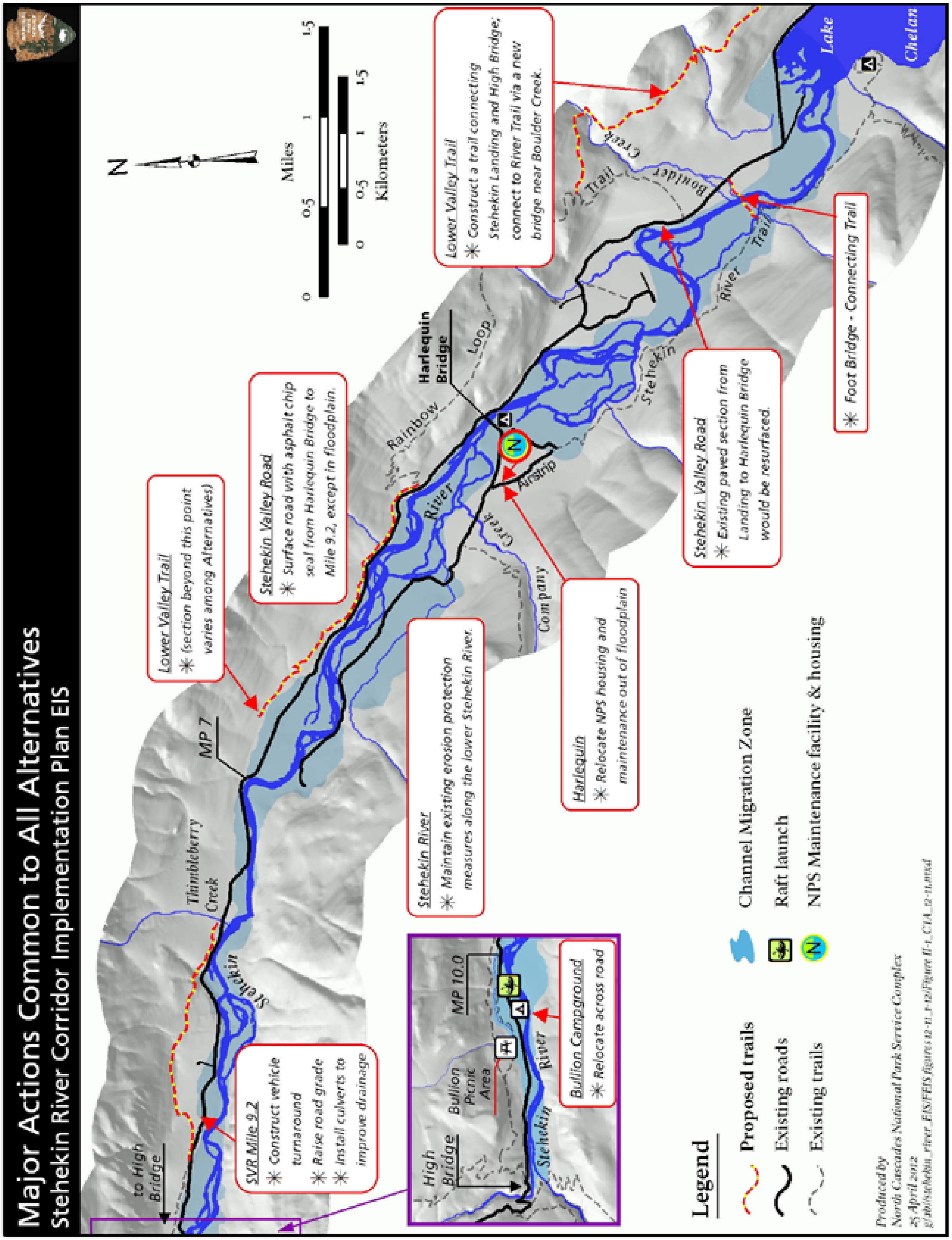
Floating large woody debris could continue to be removed from the head of Lake Chelan and used for NPS management projects. Individual pieces could also be turned or trimmed (subject to NPS approval) to maintain safe rafting in the Stehekin River, while logjams could only be removed to protect Harlequin Bridge and public roads.

The Company Creek Road would be maintained in its existing alignment and existing erosion protection measures along the Stehekin Valley and Company Creek roads would be maintained, including the 400-foot-long levee constructed in the 1980s. The levee has virtually no effect on floodplain utilization because of its short length and location and is necessary to maintain the Company Creek Road in place as called for by the GMP.

The Stehekin Valley Road at Wilson Creek, Milepost 8.0, and Frog Island would remain in place in all alternatives because these locations have severe erosion problems and no viable reroutes. Actions to protect these areas, however, would vary among the alternatives. Grade-control structures designed to maintain sheet flow in floodplains during large floods at Mileposts 7.0 and 9.2 on the Stehekin Valley Road and along the upper Company Creek Road would also be maintained. These structures were installed by public-private partnerships in 1998 and 2008, and are consistent with the concept of floodplain utilization because they protect the road from being occupied by the river.

Bullion Camp would be relocated downstream and across the road to mitigate safety concerns associated with hazard trees in the current camp. Day use, however, would be retained at the former Bullion Camp.

## Figure II-1: Major Actions Common to All Alternatives



In all alternatives, private landowners could continue to implement the U.S. Army Corps of Engineers "Advanced Flood Protection Measures" (Appendix 7), including elevating cabins or constructing measures to protect private structures from the largest floods.

## 2. Alternative 1 (No Action): Continue Current Management Practices and Existing Plan Implementation

This alternative would continue existing management practices and improvements called for by existing plans evaluated and selected in the 2005 Stehekin Valley Road Improvement Project EA and associated Finding of No Significant Impact (see Figure II-2: *Major Actions Proposed in Alternative 1*). Foremost among these would be continuing implementation of the 1995 GMP, as described previously under "Actions Common to All Alternatives (1 - 5)," and the 1995 LPP (NPS LACH 1995b).

Implementation of the 1995 LPP would continue, using existing criteria and potential exchange lands. Decisions regarding land acquisition priorities would continue to be based on properties identified with currently out-of-date floodplain boundaries and the goal of protecting scenic resources (areas of high visual sensitivity) along the Stehekin Valley Road. The Stehekin Valley Road would be retained in its existing alignment.

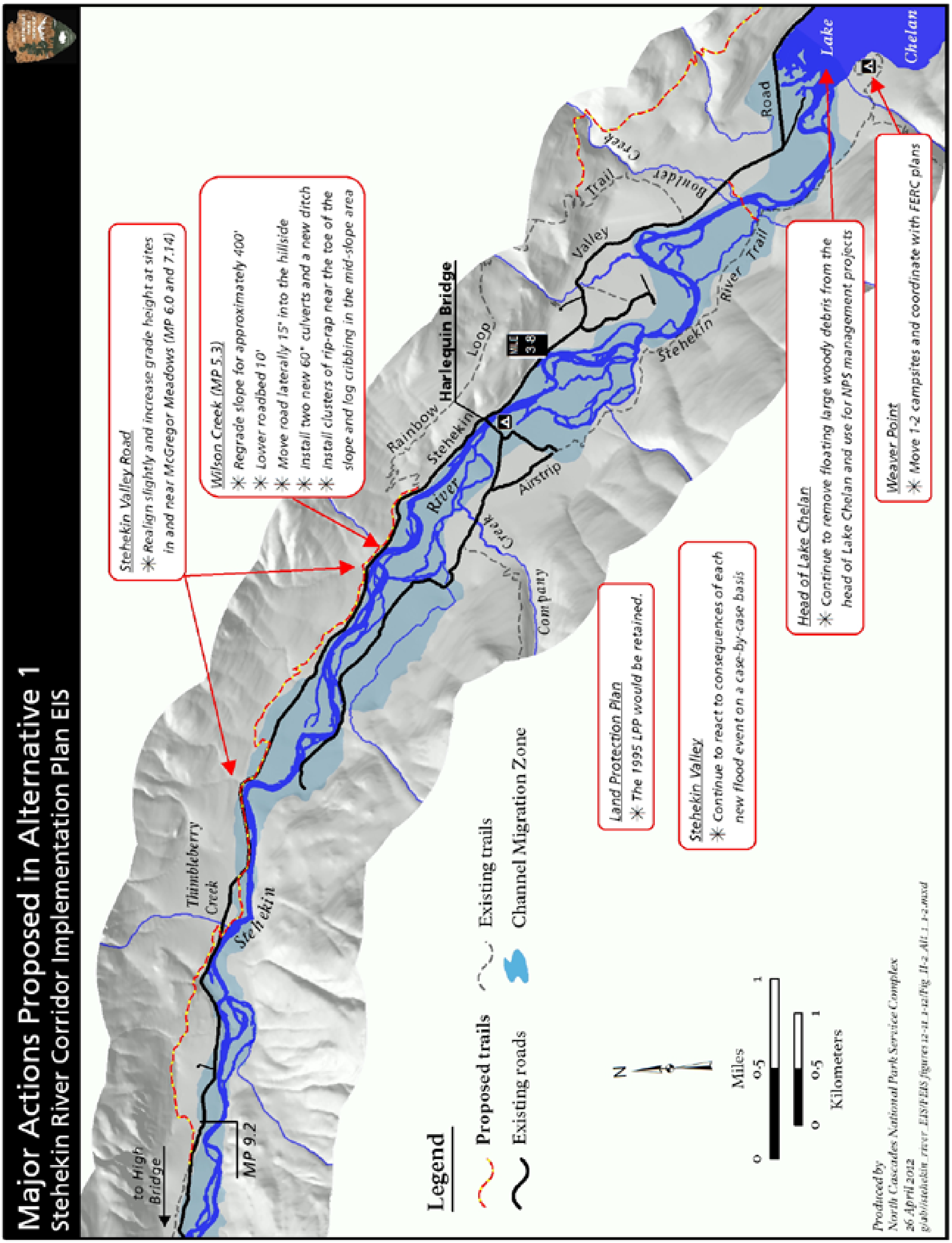
Stehekin Valley Road Improvement Project actions would be implemented and would include rehabilitation and surfacing of the road with an asphalt chipseal for 4.9 miles from Harlequin Bridge to the winter turnaround (Milepost 9.2), except for areas within the floodplain. There would be a slight realignment (between Mileposts 6.0 and 6.5) and two grade increases (from Milepost 6.25 to 6.53 and from Milepost 6.95 to 7.14) using approximately 5,600 cubic yards of fill through McGregor Meadows, as well as implementation of erosion protection measures at Wilson Creek (riprap clusters) (NPS LACH 2005). To retain the roads, Alternative 1 would also include maintenance of, but not major improvements to, existing erosion protection measures along the lower Stehekin River. Routine maintenance actions, including snow removal; spring opening; unpaved road grading, shaping and repair; paved road asphalt patching; ditch clearing; culvert cleaning; vegetation maintenance; traffic control striping; and sign replacement, would also continue as needed. It is anticipated that existing pavement would be resurfaced during or shortly after road projects above Harlequin Bridge.

In Alternative 1, unlike other alternatives, the NPS would continue to react to the consequences of each new flood event on a case-by-case basis, producing individual environmental assessments (EAs) as needed to implement management actions.

Floating large woody debris could continue to be removed from the head of Lake Chelan and used for NPS management projects. Individual pieces could also be turned or trimmed (subject to NPS approval) to maintain safe rafting in the Stehekin River, while logjams could only be removed to protect Harlequin Bridge and public roads.

Parts of the Stehekin Valley Road and Company Creek Road would continue to lie adjacent to and within the floodplain / channel migration zone of the Stehekin River. Over time, it is anticipated that this would require the NPS to install additional erosion protection measures in the river (e.g., rock barbs) to protect roads and public facilities. There would continue to be limited improvements to visitor and administrative facilities within the lower Stehekin Valley to implement the GMP. In Alternative 1, rehabilitation of the Stehekin Valley Road would be

**Figure II-2: Major Actions Proposed in Alternative 1**



implemented upon approval of this DEIS. Replacement and relocation of the maintenance facility and NPS housing (NPS Tracts 06-118, 06-104, 06121, and 06-122) would be implemented following site specific environmental analysis and approval of a tiered environmental assessment.

Recreational opportunities associated with the Stehekin River would continue, including camping, rafting, and hiking. As noted above, the Lower Valley Trail would be constructed to link the Landing with High Bridge, including connecting it to the Stehekin River Trail with a bridge near the mouth of Boulder Creek. In this alternative the trail would use 6.1 miles of existing trail and would require 6.3 miles of new trail construction.

## 3. Alternative 2: At Risk Public Facilities Removed From the Channel Migration Zone Where Possible; More Priority Land Exchange / Acquisition in the Channel Migration Zone

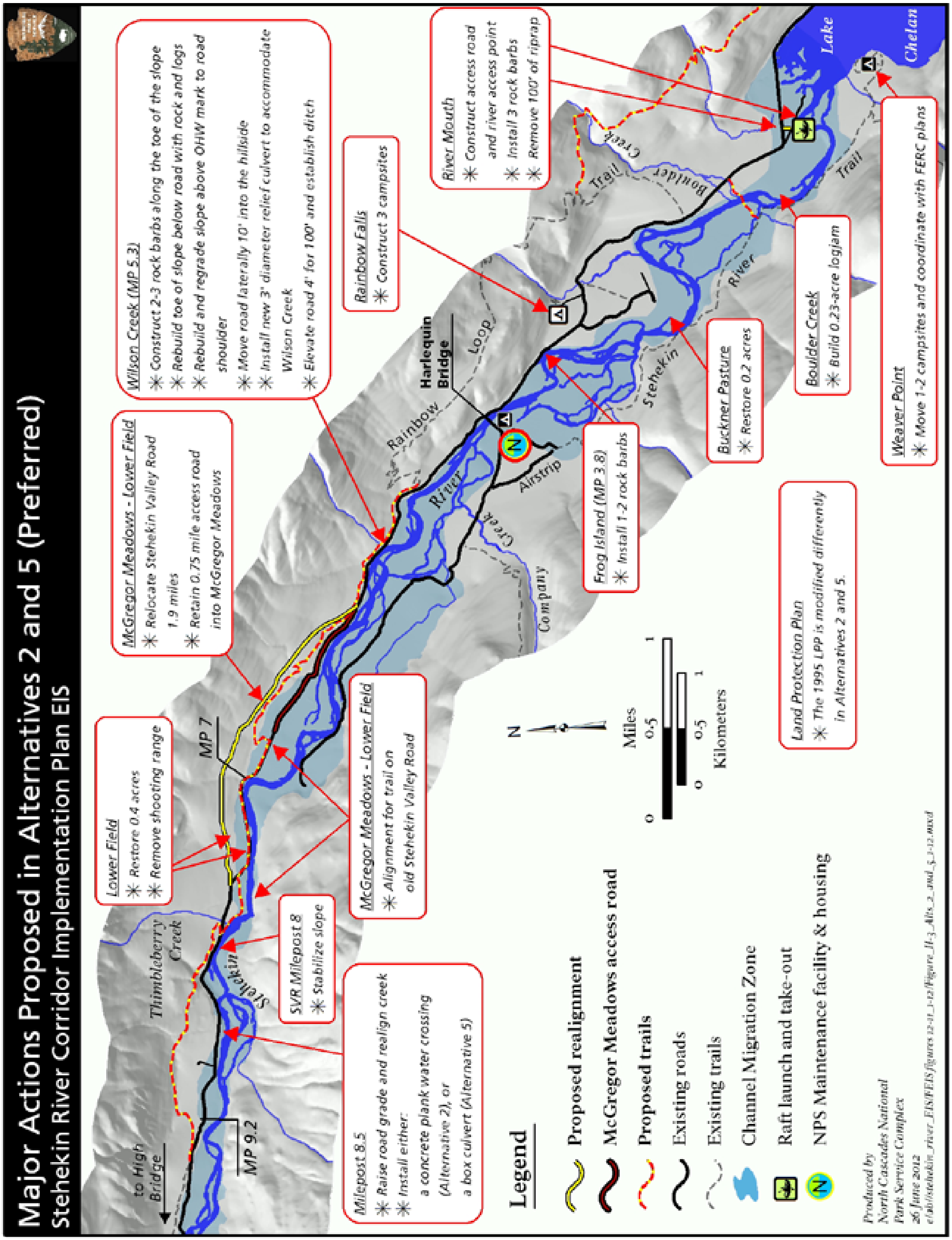
Compared to other alternatives, Alternatives 2 (and 5) would allow the Stehekin River the most space to utilize its floodplain and move within its natural channel migration zone over time (see Figure II-3: *Major Actions Proposed in Alternatives 2 and 5*). Bank stabilization is proposed at three new sites to protect the road, including at the Stehekin River mouth, Milepost 3.8 (Frog Island), and Milepost 5.3 (Wilson Creek). At Mileposts 3.8 and 5.3 the river is at the edge of the channel migration zone, and relocation into steep cliffs is not feasible. Therefore rock barbs have been proposed at these locations. As in other alternatives, Alternative 2 would also implement GMP provisions (including maintenance facility and housing relocation and construction of the Lower Valley Trail); however, there would be a change in the use of large woody debris to implement erosion protection / habitat restoration measures. Alternative 2 would include limited use of wood from logjams in the river mouth area up to Boulder Creek, where the Stehekin River is influenced by backwater from Lake Chelan during flooding. Such use would only be from the tops of prescreened jams, and only if the jam would not be destabilized. The NPS would collect and stockpile wood from logjams after obtaining permits from federal and state agencies.

The revised 2010 LPP would be used to encourage relocation of private property from within the floodplain / channel migration zone to outside the channel migration zone, using management actions such as land exchange or land acquisition from willing sellers. Land protection priorities would identify specific properties that are within the channel migration zone. If development at these sites was claimed by the river, debris from cabins, wells, and septic systems, including effluent, would be incorporated into the river. The criteria in the LPP used to identify NPS lands for potential exchange has been weighted more toward relocating private development from the floodplain in Alternatives 2, 3, and 5 than in Alternative 4 (see Appendix 11 for the priority ranking of private lands in Alternatives 2 and 3 and Appendix 13 for Alternative 5). In all action alternatives, new exchange parcels outside the channel migration zone would be made available, while some lands available for exchange in the 1995 GMP would no longer be available due to new or changed conditions or in recognition of new information.

The Stehekin Valley Road would be rerouted from Milepost 5.7 to 7.5. Because the reroute has been professionally designed to meet or exceed modern road standards, the alignment meets key principles for safety, design and maintenance.

An access road would be maintained into McGregor Meadows from Milepost 5.7 to 6.5, to the last parcel of private property (07-157), until it is no longer needed. From a turnaround at the

## Figure II-3: Major Actions Proposed in Alternatives 2 and 5




*See Appendix 17 for a separate map of Major Actions Proposed in Alternative 5.*

end of the access road, administrative access would continue to be provided to the grade-control structures at Milepost 7.0. From Milepost 6.8 to 7.5, the road would be rehabilitated as part of the Lower Valley Trail. The portions of the Stehekin Valley Road before and after the reroute would also be rehabilitated and surfaced with an asphalt chipseal.

Under Alternative 2, there would also be a series of erosion protection measures to stabilize those sections of the Stehekin Valley Road that are at the edge of the channel migration zone and cannot be relocated without major slope removal or extensive new road construction. Rock barbs would be constructed at Wilson Creek (two to three barbs) and Frog Island (one to two barbs). Three more barbs and a small logjam would be located at a key point on the left bank (looking downstream) above the river mouth. One or two of the barbs would replace 100 feet of rip-rap, and the bank would be revegetated with native shrubs. Another logjam would be constructed near Boulder Creek atop a grade-control structure (avulsion sill) away from the bank of the river and back into the forest. Stabilization of the raveling slope at Milepost 8.0 would be improved by laying back the uppermost part of the slope brow, which produces most of the rocks that fall onto the road, and scaling (removing) rocks below this. A rockery wall (100 - 150 feet long and three to eight feet high) would also be added at the base of a portion of the slope. At Weaver Point, bank stabilization would be coordinated with plans under development by Chelan PUD for recreation, erosion, and cultural resource management. Riparian restoration and/or bioengineering (layered planting using native shrubs) would enhance riparian vegetation along the bank, at the Lower Field, Buckner Homestead hayfield and pasture, Wilson Creek, Frog Island, and the river mouth.

Compared to Alternative 1, Alternatives 2 - 5 propose some manipulation of woody debris within the Lake Chelan backwater zone (which extends 0.25 mile from the head of the lake, at full pool, up the Stehekin River). In this area of the lower Stehekin River and at Harlequin Bridge, large logjams that threatened public roads, water quality, public safety, and regular access to private property could be altered to relieve threats. Woody debris from the tops of some logjams and from floating logs in Lake Chelan could also be made available to landowners (for agency-permitted erosion protection) after it was collected and sorted by the NPS. The wood could only be used in the channel migration zone for erosion protection and/or restoration projects and/or Advanced Flood Protection Measures. This action would limit importation of large rock and acknowledges the large amount of wood currently on the river.

Recreational opportunities, including camping, rafting, and hiking, associated with the Stehekin River would be enhanced. As in Alternative 1, the Lower Valley Trail would be constructed to link the Landing with High Bridge, including connecting it to the Stehekin River Trail. In this alternative (as in Alternatives 3 and 5), fewer miles of new trail (4.6 miles) would be needed since the trail would use some former roadway (1.7 miles) and existing trail (6.2 miles). New group camping opportunities would be located at Purple Point Horse Camp to replace the group campsite at Harlequin when it is seasonally flooded. Approximately three new individual sites would also be located near Rainbow Falls. In addition, a new river access point would be provided near the Stehekin River mouth, which would require a small new parking area and a 300-foot-long access road off of the Stehekin Valley Road. Because the shooting range is located along the proposed Lower Field Reroute, it would be closed and restored. No replacement shooting range would be constructed.

## 4. Alternative 3: At-Risk Public Facilities Removed from Channel Migration Zone in Most Areas; Same Land Protection Plan as Alternative 2

Alternative 3 would allow the Stehekin River slightly less room to move within its natural channel migration zone and requires the use of different erosion protection measures than in Alternatives 2 and 5 (with four barbs and five logjams, instead of six to eight barbs and two logjams) (see Figure II-4: *Major Actions Proposed in Alternative 3*). As in other alternatives, Alternative 3 would implement the GMP replacement and relocation of the maintenance facility/housing and construction of the Lower Valley Trail. Different erosion protection approaches were developed since the rock barbs and logjams have different benefits and installation impacts. The number of erosion protection measures increase from Alternative 2 / 5 through Alternatives 3 and 4, consistent with the overall degree to which each alternative would constrain the river. As in Alternative 2, there would be a minor change regarding the use of woody debris, and the revised LPP would be used.

The reroute of the Stehekin Valley Road in Alternative 3 would be slightly shorter than the one proposed in Alternative 2. The reroute would begin at Milepost 5.7 and would end at Milepost 7.3 (see Figure II-5: *McGregor Meadows Reroute Map*). With the shortening of the reroute (compared to Alternatives 2 and 5), the portion of the existing road that borders Lower Field would be stabilized with riparian vegetation and rock barbs. As in Alternatives 2 and 5, an access road from Milepost 5.7 to Milepost 6.5 would be retained up to the last private parcel in McGregor Meadows until it is no longer needed; and administrative access would also be maintained to Milepost 6.8 for maintenance of grade-control structures. From Milepost 6.8 to Milepost 7.3, the road would be rehabilitated as part of the Lower Valley Trail.

Four rock barbs would be constructed along the bank at Weaver Point (two barbs) and Lower Field (two barbs), while large logjams would be constructed at Weaver Point, near the Stehekin River mouth, Boulder Creek (and an avulsion sill), Frog Island, and at Wilson Creek. Restoration and/or bioengineering would also occur in the same locations as in Alternative 2.

Management of woody debris would be the same as in Alternatives 2 and 5. Recreational improvements would be similar to Alternatives 2 and 5; however, additional camping opportunities would also be provided at Company Creek at a previously disturbed site outside of the Stehekin River channel migration zone, and no new river access point would be constructed near the Stehekin River mouth.

## 5. Alternative 4: At-Risk Public Facilities Removed from Channel Migration Zone in Some Areas; Less Priority Land Exchange / Acquisition in Channel Migration Zone

Compared to Alternative 1, Alternative 4 would allow for some additional movement of the Stehekin River within its channel migration zone, if private property was purchased or exchanged. Unlike Alternatives 2 and 3, if Alternative 4 was selected, the revised 2010 LPP would be revised to rank priority lands per the criteria shown later in this chapter in Table II-7. As in Alternative 1, without a reroute, Alternative 4 would constrain the movement of the Stehekin River from a large part of its floodplain through McGregor Meadows and at Lower

**Figure II-4: Major Actions Proposed in Alternative 3**

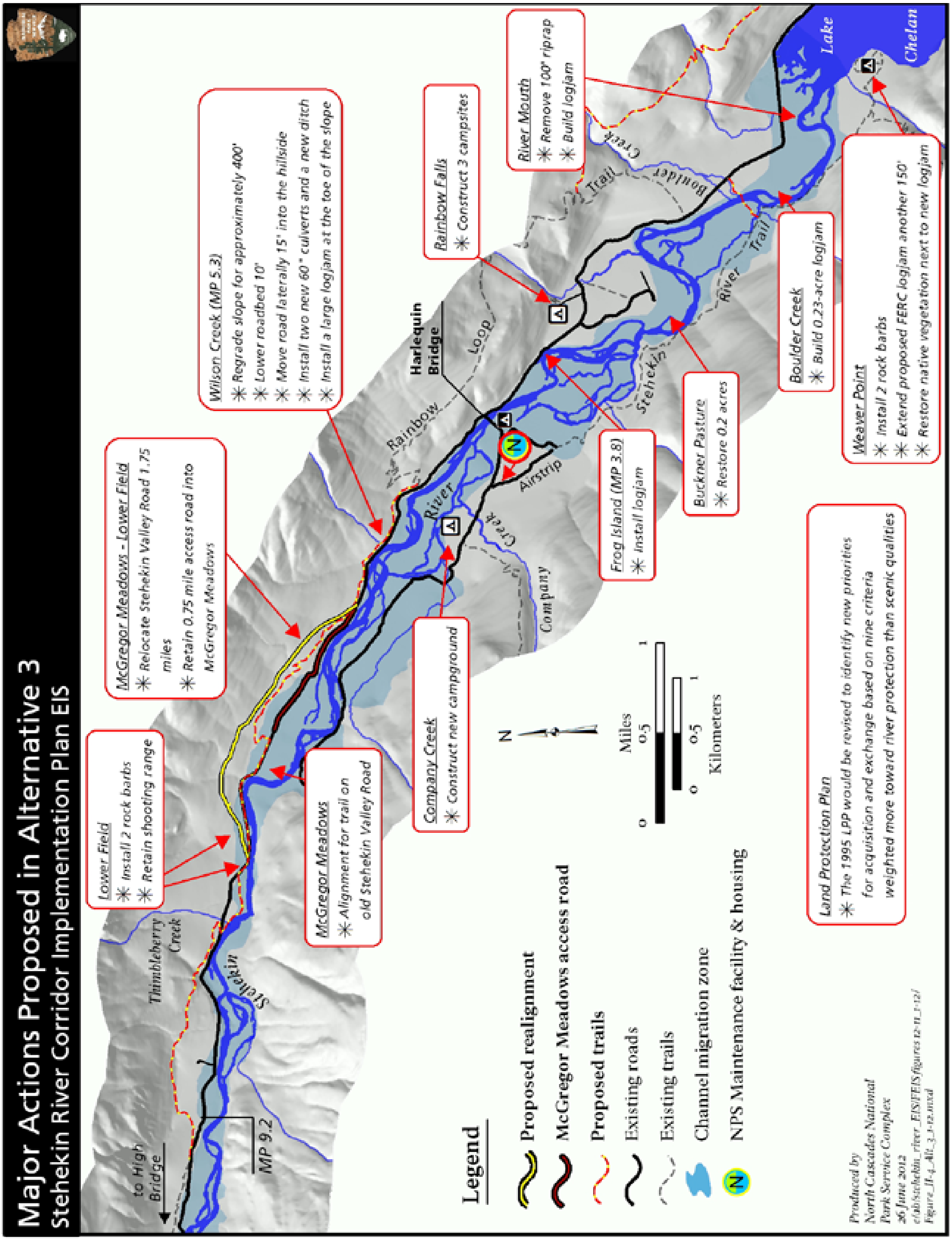
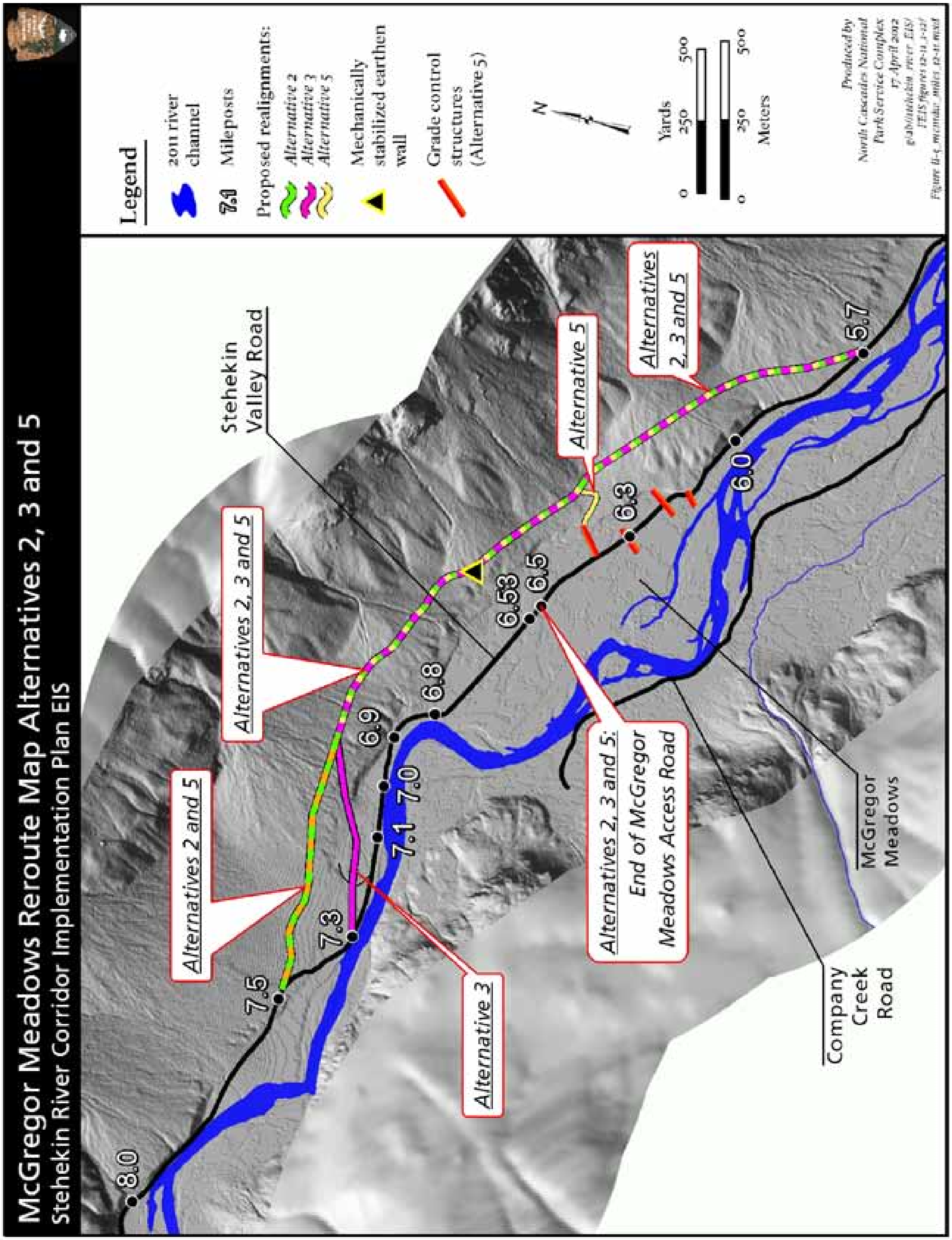


**Figure II-5: McGregor Meadows Reroute Map**



Field because it would raise the grade of the road through McGregor Meadows (Figure II-6: *Major Actions Proposed in Alternative 4*). The LPP revision would be different than in Alternatives 2 and 3. Appendix 11 lists the priority ranking of private lands for Alternatives 2 and 3 while Appendix 12 lists the priority ranking of private lands for Alternative 4 and Appendix 13 lists the ranking for Alternative 5. Exchanges would be focused less on properties along the river, and more on sustaining the current development pattern. Because of this, there would be fewer parcels with a high priority for acquisition that would facilitate their removal from the channel migration zone by willing sellers. Some private development in flood-prone areas near the river channel, however, would be considered for exchange or purchase. Actions associated with GMP implementation (including replacement and relocation of the maintenance facility and NPS housing and construction of the Lower Valley Trail) would be the same as in "Actions Common to All Alternatives (1 - 5)."

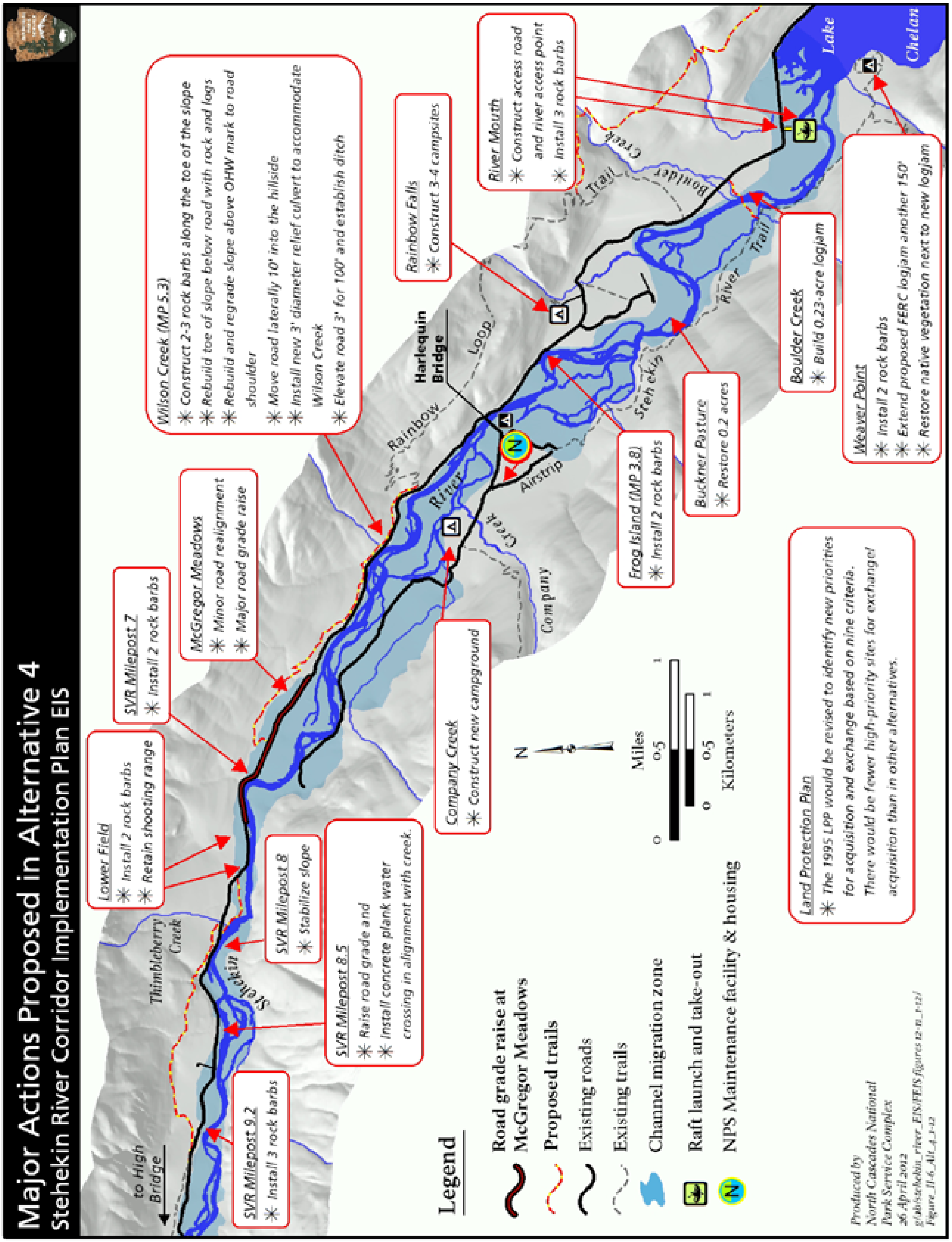
As in Alternatives 2, 3 and 5, there would be stabilization and riparian restoration of the bank along the Lower Field. As in Alternative 1, instead of a reroute around McGregor Meadows, the Stehekin Valley Road would be raised to minimize the potential for future flood damage, and 4.9 miles of the road would be rehabilitated and resurfaced between Harlequin Bridge and the winter turnaround in addition to the area that would be resurfaced from the Landing to Milepost 9.2.

There would be additional placement of barbs and bioengineering for erosion protection measures implemented along the Stehekin River, not only at the Lower Field (as in Alternative 3), but also near Milepost 7.0 and Milepost 9.2. To maintain the Stehekin Valley Road in its existing alignment, Alternative 4 would have the greatest number of locations (seven) where erosion protection measures would be undertaken. Altogether 16-17 rock barbs would be constructed at Weaver Point (two barbs), Stehekin River mouth (three barbs), Frog Island (two barbs), Wilson Creek (two to three barbs), Lower Field (two barbs), Milepost 7.0 (two barbs), and Milepost 9.2 (three barbs), and a large logjam/avulsion sill would be constructed at Boulder Creek along the bank extending into the forest. Riparian restoration and/or bioengineering would also occur in the same locations as in Alternatives 2, 3 and 5.

Use of woody debris would be the same as in Alternatives 2, 3 and 5, with both NPS and private permitted use, except that woody debris could be used from the tops of prescreened logjams from areas below the Bullion raft launch, including at McGregor Meadows. (This is in contrast to Alternatives 2, 3 and 5, which restrict taking logs from the river to below Boulder Creek in the Lake Chelan backwater zone).

Recreational improvements would be the same as in Alternative 3 except there would be a new river access point in this alternative, as in Alternatives 2 and 5. Construction of the Lower Valley Trail would be similar to that proposed in Alternative 1, with 6.1 miles of existing trail and 6.3 miles of new trail.

## Figure II-6: Major Actions Proposed in Alternative 4



## 6. Alternative 5: At-Risk Public Facilities Removed from Channel Migration Zone Where Possible; Priority Land Exchange / Acquisition in Most Vulnerable Areas (NPS Preferred)

Actions would be similar to Alternative 2, except for the following differences:

- On the proposed reroute of the Stehekin Valley Road a mechanically stabilized earth (MSE) wall would be constructed to avoid a slightly longer reroute with more slope impacts;
- A 940 - 1,200 feet-long Reroute Access Connector (linking the McGregor Meadows Access Road and the realigned Stehekin Valley Road) would be constructed;
- Instead of implementing the revised 2010 LPP, the LPP would be revised to emphasize the most threatened sites within zones of channel instability;
- In addition to the erosion protection measures identified in Alternative 2, a) four grade control structures could be constructed (beneath three driveways and from the Stehekin Valley Road to the access spur); b) the fill-side shoulder would be stabilized at Skinny Wilson's (Milepost 5.1); and c) there would be a box culvert instead of a concrete plank ford at Milepost 8.5;
- NPS housing could be constructed at other appropriate locations in the lower valley; and
- The location and use of part of the Lower Valley Trail would be modified.

The MSE wall (Figure II-7) would be located above NPS Tract #7-157 on the reroute, above an existing private gravel pit. The height of the wall would vary from two to three feet at the ends to approximately 16 feet near the middle; however the exposed (visible) height would be approximately three feet less because the bottom part of the wall would be buried. The wall would be approximately 230 feet long and native shrubs and trees would be planted in the soil below the bottom of the wall to help hide the wall face from view. The components of the wall would also be permanently treated to blend with the colors of the surrounding stone and soil. Its construction would reduce the loss of additional large trees along the reroute and would minimize the amount of slope disturbance (cuts and fills) in this steep area.

The MSE wall would be constructed by excavating the wall foundation elevation and then building the wall in layers. Each layer would include wire facing, a geotechnical fabric layer to retain backfill, and a reinforcing layer to connect the facing to the backfill behind the wire. Soil would be overlain on the top of the wall and a guardrail installed along the road shoulder to increase safety.

The Reroute Access Connector would provide access to the McGregor Meadows area if the existing alignment washes out and repairs are too expensive and/or the NPS cannot obtain needed permits to repair it (i.e. river runs down road through summer). The connector would be approximately 12-feet wide and 0.22 miles (940 - 1,200 feet) long. From the road reroute, 300 feet would be constructed across private property (NPS Tract 07-201) via an easement and would join the reroute with the existing McGregor Meadows Access Road.

**Figure II-7: An example of a Mechanically Stabilized Earth (MSE) Wall from Mount Rainier National Park (similar to the wall that is proposed in Alternative 5)**

As in Alternative 2, the LPP would be used to encourage relocation of private property from within the floodplain / channel migration zone to outside of it, using management actions such as land exchange or land acquisition from willing sellers. Land protection priorities would identify specific properties most threatened by the Stehekin River within McGregor Meadows and other vulnerable areas (deposition zones and active parts of debris cones). As in Alternatives 2 and 3, these criteria would be weighted more toward removing private development from threats by the river than in Alternative 4; however unlike in Alternative 2, the focus of the criteria would also include protection of scenic resources along the Lake Chelan shoreline. As in Alternatives 2 - 4, new exchange parcels outside the channel migration zone, or other hazard zones, would be made available, while some lands available for exchange in the 1995 GMP would not be available. One additional parcel (a corral that is part of Tract 05-122) not in the revised 2010 LPP, however, would also be available for exchange, but only for agricultural use. A larger parcel of land (part of Tract 08-104) above the Stehekin Valley Ranch is also proposed for exchange. In Alternative 5, this area would be 10.2 acres, rather than 5.2 acres (as in Alternatives 2 - 4).

The revision to the LPP in Alternative 5 would include eight criteria, including two new ones (visual sensitivity and presence in a debris cone hazard zone). In Alternative 5, the primary driving factors include flooding and streambank erosion impacts on development. Flooding and erosion are most pronounced in areas where the river deposits gravel and large wood. These areas are located at distinct points where the valley widens (McGregor Meadows), between the large tributary alluvial fans of Company, Boulder, and Rainbow Creeks, and at the Stehekin River mouth. Hazardous areas are also located on debris cones where rapid deposition can occur at any time of year. Similar hazard concerns exist for alluvial fans within Lake Chelan NRA, but that threat is considered less severe and the criteria used to evaluate those concerns are weighted less. Other criteria include the presence of wetlands, rare species habitat, and cultural resources, as well as a criterion that emphasizes larger, undeveloped blocks of land within the valley.

Beneath three driveways into McGregor Meadows and from the McGregor Meadows access road to the access spur, four new grade control structures could be designed to maintain sheet flow, slow avulsion, and to limit the amount of gravel introduced to the Stehekin River from McGregor Meadows. The grade control structures would be a combined 1,000 feet long, six feet wide and three feet deep, and would be constructed of approximately 600 cubic yards of rock. They would also extend across the Stehekin Valley Road. The grade control structures would be constructed through a public-private partnership, with the NPS providing technical assistance and property owners responsible for the construction on their property.

At Milepost 5.1 (across from the Skinny Wilson homestead), 40 feet of road shoulder would be stabilized by constructing a rock wall to replace the decomposing logs that currently support the road shoulder. A large (20-inch) big-leaf maple at one end of the section would be retained.

At Milepost 8.5, instead of a concrete plank water crossing as in Alternatives 2 - 4, a box culvert would be used to improve access for bicyclists, and the road grade would be raised three to four feet over a distance of approximately 450 feet. The culvert would be approximately three to four feet x six feet x 30 feet and would have pre-cast concrete wing walls to minimize its length. A removable concrete lid is proposed. To facilitate water reaching the Stehekin River, an outlet relief channel six-feet wide, three-feet deep and 100-feet long (following the natural channel) would be created. Rip-rap check dams would be used to slow the flow as it enters the Stehekin River. Tree wells may be required to protect some large cottonwoods near the intersection with the private road. Some, however, may need to be removed. Other smaller trees would need to be removed to create the outlet channel.

Similar to Alternative 2, the NPS maintenance area and some housing would be constructed on land identified in the GMP for that purpose near the airstrip. Unlike Alternative 2, NPS housing could also be constructed in other appropriate locations in the lower valley. As with development of the new maintenance area, additional environmental analysis would be needed.

The Lower Valley Trail alignment would be modified in the vicinity of the Stehekin Valley Ranch to minimize impacts to private property. It could also include another section of multi-use trail from the Stehekin Valley Road to Buckner Orchard using the alignment of the historic entrance (as recommended in the Buckner Homestead Historic District Management Plan). The proposed Lower Valley Trail would be constructed as described in the DEIS except that the trail would not go behind the ranch and would instead connect to the Stehekin Valley Road by linking with the trail at Bullion at Milepost 9.2. Bicycle use would also be allowed on the decommissioned portion of Stehekin Valley Road (McGregor Meadows Access Road and area above Milepost 6.5 to the Lower Field) but there would be no manipulation of the Stehekin River to protect this trail alignment for bicycles. In the future, additional bicycle access would likely be available by implementing the Buckner Homestead Historic District Management Plan recommendation to construct a multi-use trail from the Stehekin Valley Road to Buckner Orchard along the historic entrance road, instead of Buckner Lane (which would be closed to bicycle use). It is envisioned that the Lower Valley Trail could be constructed in segments over an extended period of time (e.g. ten years).

# B. ACTIONS COMMON TO ALL ALTERNATIVES (1 - 5)

This section gives a detailed overview of project components that would be implemented regardless of which alternative is selected, followed by a more detailed discussion of each action. The alternatives are tiered off the GMP and other recent Stehekin plans, including the Road Improvement Project. A number of individual actions that are part of these plans would be part of all alternatives.

- **GMP Implementation:** Actions would include relocating the maintenance area, NPS housing, and one to two campsites out of the floodplain, constructing a fire cache and dorm, and constructing the Lower Valley Trail, including its connection with a bridge to the Stehekin River Trail.
- **Road Maintenance:** Ongoing maintenance of the Stehekin Valley Road and Company Creek Road would continue, including cyclic, seasonal, and routine (day-to-day) maintenance activities.
- **Harlequin Bridge:** Harlequin Bridge would be maintained in its current condition. If replacement was proposed, a longer span would be recommended. As called for by the GMP, logjams threatening the bridge would be removed.
- **Company Creek Road and Stehekin Valley Road—Private Access:** Access would be maintained to the existing end of both roads, although actions differ by alternative on the Stehekin Valley Road.
- **Existing Company Creek Road Erosion Protection Measures and Strategy:** As called for by the GMP, Company Creek Road would continue to be maintained in its existing alignment. The array of erosion protection measures along the upper Company Creek Road would continue to be maintained and would be replaced if necessary.
- **Existing Stehekin Valley Road Erosion Protection Measures and Stehekin Valley Road Improvement Project (2005) Implementation:** The array of erosion protection measures along the Stehekin Valley Road would continue to be maintained and would be replaced if necessary. Road rehabilitation (surfacing, pullouts, culverts, etc.) would occur in the sections of the Stehekin Valley Road that would be treated the same by all alternatives. (Road Improvement Project proposed grade raises and Wilson Creek actions vary by alternative.)
- **Flood Protection Measures:** The NPS would continue to respond to emergency conditions as needed to protect NPS facilities. To allow the Company Creek Road to remain in its current location (as called for by the GMP), the existing levee would be retained. Removal of administrative structures from the floodplain / channel migration zone, including the existing maintenance area and housing, would also occur. Near McGregor Meadows, grade-control structures designed to maintain shallow flood flows (sheet flow) on both sides of the river would be maintained until no longer needed.
- **Materials Sources, Construction Staging, Restoration, and Mitigation/Monitoring:** The success of road rehabilitation called for by the Road Improvement Project and other actions associated with this plan, as well as limiting its impacts on Lake Chelan NRA resources through project actions would be ensured through a variety of measures common to construction projects implemented in Stehekin.

## 1. GMP Implementation

In accordance with the GMP, the NPS would:

- Relocate administrative facilities (maintenance and housing) from the Stehekin River floodplain to a five- to eight-acre site near the north end of the airstrip. In Alternative 5, housing could also be sited in other sustainable locations in the lower valley. The design of the proposed new NPS facilities would have architectural components that mimic the local vernacular. Actions involving these administrative facilities would require separate environmental analysis once specific locations and building configurations have been identified and therefore are not analyzed in detail in this document.
- Construct a new fire cache, heli-spot, and dormitory near the airstrip.
- Construct a Lower Valley Trail and its connection to the Stehekin River Trail (a footbridge crossing of the Stehekin River).

### Relocate Administrative Facilities and Construct New Maintenance Compound

The current maintenance compound and septic system is within the 100-year floodplain and is subject to routine inundation and flood damage during peak flows occurring every few years. Hazardous-material storage is elevated, but is currently located within the 500-year floodplain. Both would be relocated to near the north end of the airstrip out of the floodplain and channel migration zone. Proposed plans call for comprehensive design and construction of a replacement maintenance compound near the airstrip. Future site planning would identify building locations and footprints and would be subject to additional environmental analysis. Replacement and

#### Maintenance Area Problems

**Susceptibility to Flooding:** During floods in November 1995, October 2003, and November 2006, the maintenance compound and access road were under several feet of water. Standing water and silt damaged stored electrical appliances, furniture, paper products, and other equipment. Emergency response was delayed because equipment at the maintenance area is essential for evacuation of residents and visitors as well as for repairing roads. Heavy equipment, such as the backhoe and grader, are the only high-clearance vehicles that can get to or from the compound during flooding. Because of increasing flood frequency and severity, the cost of repairs following flooding at the maintenance compound is increasing. In 1995, damage cost approximately $30,000 to repair, and in 2003, more than $56,000.

**Inadequate Building Construction:** The maintenance facilities, which were constructed in the 1950s or 1960s or were inherited from the U.S. Forest Service (USFS), have exceeded their useful life. The poorly designed facility compound includes a collection of cramped, poorly lit, under-insulated buildings, generally not constructed to function as maintenance facilities. These facilities are inadequately designed to handle snow-load. Roof-pitch and physical locations make it difficult to remove snow. Several roofs must routinely be hand-shoveled to prevent collapse. Buildings are also inadequately insulated and are heated with various systems, including propane, wood pellet, and electric heating. Due to the distance from supply facilities, extra parts for each of these must be kept on hand.

**Fuel Storage:** Gas, diesel, and other toxic substances are stored within the 500-year, or regulatory, floodplain. The site is therefore out of compliance with Director's Order 77-1.

relocation of the maintenance area and fire cache to an area not subject to flooding would result in improved emergency access to equipment and long-term protection of buildings and structures and would minimize potential future impacts to water quality from debris and hazardous materials stored in the floodplain.

Development of the relocated maintenance area would include the functions and buildings in Table II-2: *Proposed Maintenance Compound Structures*.

**Table II-2: Proposed Maintenance Compound Structures**

| Building | Area |
|---|---|
| Equipment repair shop | 4,000 sq ft |
| Maintenance storage (propane, hazardous materials, supplies) | 4,800 sq ft |
| Search and rescue / fire cache | 2,400 sq ft |
| Solid waste compaction / recycling | 2,000 sq ft |
| Helipad | 400 sq ft |
| Gas station | 800 sq ft (two 6,000 gallon fuel-storage tanks and dispensing facility) |
| Power generation | Unknown |
| Water distribution | 100,000 gallon tank 400 sq ft foundation<br>10 × 10 ft well house |
| Wastewater treatment | Unknown; likely to be individual septic systems |
| **Total circulation space** | **10,890 sq ft** |
| **Total building space** | **14,900 sq ft** |

*Note: Total figures do not include unknown categories.*

The relocated maintenance area would be designed to meet a Leadership in Energy and Environmental Design (LEED) rating of silver or greater and would include associated utility systems, including possible solar power generation. As construction of the new maintenance buildings occurred, the existing maintenance facilities would be dismantled and their sites restored; however, some facilities in good condition could be relocated and repurposed.

## Relocate and/or Construct Park Housing

Implement the GMP action to relocate housing threatened by flooding and construct new seasonal and permanent housing at the north end of the airstrip. In Alternative 5, housing could also be sited in another suitable location in the lower valley. Initial design has revealed that there is likely not enough space to accommodate both the maintenance area and all of the housing in one location at the airstrip. During internal scoping for the maintenance and housing area taking place concurrently with development of the SRCIP, other options for relocating housing have also been identified. Up to 11 housing units could be constructed; however, the exact location of the housing would be based on site specific design and planning beyond the scope of this plan. Future site planning would identify building locations and footprints and would be subject to additional environmental impact analysis.

## Consistency of Proposed Maintenance and Housing Area with Adjacent Airstrip

During the planning process for facilities near the airstrip, the NPS would continue to work with WSDOT Aviation and other stakeholders to take the presence of the airstrip into consideration.

## Construct Lower Valley Trail

Implement the GMP recommendation to create a Lower Valley Trail to connect High Bridge to Stehekin Landing. As noted in the GMP:

> *An 11-mile pedestrian and horseback trail would be developed from the Landing to High Bridge… A pedestrian and horseback riding trail system that connects key lower valley features to the Stehekin Valley Road would also be developed. (NPS LACH 1995a:33)*

The Lower Valley Trail would be maintained for horses and hikers. Bicyclists would continue to use the Stehekin Valley Road, except bicyclists could also use the McGregor Meadows Access Road and the portion of the Lower Valley Trail converted from it to avoid the hilly sections of the reroute. Should the road be damaged by the river, no specific action would be taken to reconstruct it if bicycle use cannot be continued. Other sections of the trail would not be open to bicycle use.

The trail would begin at the Landing and climb the hillside either using the Purple Creek Trail or heading off from the Imus Trail to reach a relatively flat bedrock bench. The trail alignment would traverse the bench above Lake Chelan and under one option descend in the vicinity of Little Boulder Creek (approximately 1.9 miles new trail), cross Boulder Creek and meet the Rainbow Loop Trail near the valley floor (approximately 0.6 mile new trail) (Alternatives 1 - 4). The trail would also connect with the spur trail to the footbridge across the Stehekin River. Another option could include maintaining the elevation of the bench crossing Little Boulder and Boulder creeks to meet with the Rainbow Loop Trail above the valley floor (Alternative 5). Under either option, the trail would then follow the Rainbow Loop Trail for the rest of its length to the upvalley trailhead (approximately 3.8 miles, existing trail). From the upper Rainbow Loop Trailhead, it would travel a flat, mostly open area paralleling the road at approximately 1,300 feet elevation and through the Skinny Wilson property to the site of the proposed road reroute (approximately 0.9 mile new trail).

Depending on the alternative, the trail would:

- Alternatives 1 and 4: Connect with the Old Wagon Road alignment and generally follow it to the Stehekin Valley Ranch (approximately three miles new trail).
- Alternatives 2, 3, and 5: Follow the McGregor Meadows Access Road and abandoned sections of the Stehekin Valley Road (approximately 0.7 mile access road and 1.1 miles of abandoned road). The trail would cross the Stehekin Valley Road in the vicinity of 8-Mile and continue upvalley following the Old Wagon road to the vicinity of the Stehekin Valley Ranch (approximately 1.2 miles new trail)
- Alternative 5: The route would be the same as in Alternatives 2 and 3 except that the Lower Valley Trail alignment would be modified in the vicinity of the Stehekin Valley Ranch to

minimize impacts to private property. It could also include another section of multi-use trail from the Stehekin Valley Road to Buckner Orchard using the alignment of the historic entrance (as recommended in the Buckner Homestead Historic District Management Plan). The proposed Lower Valley Trail would be constructed as described in the DEIS except that the trail would not go behind the ranch and would instead connect to the Stehekin Valley Road by linking with the trail at Bullion. Bicycle use would also be allowed on the decommissioned portion of Stehekin Valley Road (McGregor Meadows Access Road and area above Milepost 6.5) but there would be no manipulation of the Stehekin River to protect this trail alignment for bicycles. In the future, additional bicycle access would likely be available by implementing the Buckner Homestead Historic District Management Plan recommendation to construct a multi-use trail from the Stehekin Valley Road to Buckner Orchard along the historic entrance road, instead of Buckner Lane (which would be closed to bicycle use).

In all alternatives, the trail would connect with the Bullion Trail network then with the High Bridge and Coon Lake Trail (approximately 2.3 miles existing trail).

In Alternatives 1 and 4, the Lower Valley Trail would use 6.1 miles of existing trail and would require approximately 6.3 miles of new trail. In Alternatives 2, 3 and 5, the trail would use approximately 7.9 miles of existing trail or road and would require approximately 4.6 miles of new trail. The trail would be approximately two feet wide and 12.5 miles long and would take 200 - 300 days to construct depending on the alternative and crew size.

The Lower Valley Trail would tie into the existing Stehekin River Trail via a footbridge across the Stehekin River upvalley of Boulder Creek and would make use of the existing concrete bridge abutments if possible. At this location, the river is approximately 129 feet wide and the channel is relatively stable.

## Relocate Weaver Point Campsites

The NPS would continue to maintain Weaver Point Campground and to replace / relocate the boat docks. In accordance with the GMP, all alternatives would relocate one or two shoreline campsites inland. Erosion control, recreation, improvement, and cultural-resources projects related to the Lake Chelan Hydroelectric project would be integrated with NPS actions.

### Weaver Point

Weaver Point is the largest boat-in campground near the head of the lake. It contains approximately 16 campsites (including fire rings / grates, tables, potable water, and both flush and pit toilets). There is also an administrative cabin, which is being rehabilitated and which has been used in the past for park housing and may be used again.

In the 2006 flood, the mouth of the Stehekin River eroded away a major portion of Weaver Point, washing out one of the boat docks and destabilizing the piers of another. Since that time, the Stehekin River has continued to move against Weaver Point, and one of the shoreline campsites is threatened by erosion. It is likely that the river will continue to affect the shoreline, causing the need for shoreline campsites to be relocated (as called for by the GMP).

## 2. Road Maintenance

The NPS would continue to maintain the designated Stehekin Valley Road within the project area. The NPS would also continue to maintain the Company Creek Road in its current alignment for public and private vehicle access, subject to available funds and with concurrence from property owners, where no easement access authority exists.

The NPS would continue to perform regular maintenance of the road surface, including a variety of seasonal work, such as snowplowing on major roads (winter); windfall, tree, and debris removal, culvert cleaning, and pothole patching (spring); and grading, shoulder maintenance, and sign replacement (summer/fall). More substantial repairs of the road, such as culvert replacement and crack and slurry seals, is considered beyond the scope of routine road maintenance and would be subject to further planning and environmental analysis.

## 3. Harlequin Bridge

Harlequin Bridge would continue to be maintained under all alternatives. As called for by the GMP, removal of bridge-threatening logjams would occur as necessary. Because the span of Harlequin Bridge is too short, it is exposed to a higher risk of flood damage and could be damaged by erosion or a logjam during floods. When replacement becomes necessary, the NPS would recommend constructing a bridge with a longer span. A longer span bridge would be more sustainable, would have less impact to the river, and would be less susceptible to flood damage.

## 4. Stehekin Valley Road / Company Creek Road—Private Access

### No Manipulation of the Stehekin River to Protect Private Property

As stated in the GMP: "The Park Service would not manipulate the river to protect private property. No action would be taken to prevent private property owners from manipulating the river on their land to protect their property unless such actions would significantly harm recreation area resources or were in violation of local, state, or federal ordinances, regulations, or laws. Such actions would not be encouraged, however" (NPS LACH1995a: 21 - 22). Because of NPS Management Policies and the legislation that authorized the NPS to maintain the Company Creek Road, the NPS would continue to be prohibited from taking actions or expending funds solely to protect private property (see Chapter I: *Purpose of and Need for Management Action*); however, ensuring access to private property and Lake Chelan NRA lands would continue to be a priority, as would protection of public roads and facilities.

### Stehekin Valley Road / Company Creek Road Private Access

Stehekin Valley Road / Company Creek Road access would continue to be via existing driveways or spur roads off the public roads as maintained by private landowners. Under Alternatives 1 - 4, if major road failure occurred from a catastrophic river avulsion (major channel shift) and loss of major sections of either road occurred and affected private property access, the NPS would work with private landowners to determine how to restore access across federal land, if needed, or to encourage land exchange, if appropriate. Landowners would continue to be responsible for maintaining access roads on their property.

Whether restoration of access would include rebuilding the access road, rerouting, or some combination of these would be determined as it has been, on a case-by-case basis, and would be designed to limit impacts to Lake Chelan NRA resources.

Under Alternative 5, a Reroute Access Connector would be constructed from the McGregor Meadows / Lower Field Reroute across federal and private property to the McGregor Meadows Access Road (Stehekin Valley Road). Proposed grade control structures would provide flood-resistance to the existing road network in McGregor Meadows and would limit the amount of gravel added to the Stehekin River from erosion during flooding.

## 5. Existing Company Creek Road Erosion Protection Measures

### Land Use and Development (Transportation Plan Elements) Actions

"Company Creek Road would be maintained in its current alignment and condition" (NPS LACH1995a: 33).

In addition, existing erosion protection structures would be maintained and replaced as needed. These include ten rock barbs, three grade control structures, extensive bioengineering, and a 400-foot-long levee along the Company Creek Road that would need ongoing maintenance (see Appendix 5: *Cumulative Impacts Project List*).

The risk of catastrophic river avulsion (major channel shift) would remain for all alternatives. Should this occur and include loss of the Company Creek Road, road reroutes could be considered (if road repair is not feasible) to continue to provide motor vehicle access to recreation sites and to private property in the area.

## 6. Existing Stehekin Valley Road Erosion Protection Measures and Stehekin Valley Road Improvement Project Implementation

### Stehekin Valley Road Erosion Protection Measures

Similar to the Company Creek Road, numerous erosion protection measures have been implemented by the NPS along the Stehekin Valley Road (see Appendix 5: *Cumulative Impacts Project List*). As with the Company Creek Road, several erosion protection structures have been constructed to protect the Stehekin Valley Road. Over time, it is likely that some reaches of the Stehekin River would continue to fill with gravel, causing bank barbs to be rendered ineffective. As a result, future barb reconstruction or a road grade raise would be considered.

### Road Improvement Project General Improvements

Actions from the Road Improvement Project (NPS LACH 2005a) addressed by all alternatives include a series of road and drainage improvements on approximately 4.58 miles of the Stehekin

Valley Road. The majority of the road rehabilitation would occur within the existing road prism (the area affected by original construction of the road). Exceptions would include improving sight distance and drainage problems and constructing pullouts.

Road rehabilitation does not apply to the proposed reroutes in Alternatives 2, 3 and 5.

## Road Rehabilitation / Pullout Construction

The Stehekin Valley Road would be rehabilitated as a single-lane road above Harlequin Bridge, with a variable top-width of approximately 12 - 14 feet (Alternative 1) or 14 - 16 feet (Alternatives 2 - 5) and an adequate number of pullouts to safely accommodate two-way traffic. This would create a road, similar in size and characteristics, from the Stehekin Landing to Milepost 9.2.

The Road Improvement Project calls for approximately 20 new pullouts (eight feet wide by 20 feet long with a taper on each end) along the road. Five existing pullouts between Harlequin Bridge and the winter turnaround would be reconstructed or improved. Approximately eight existing pullouts would be surfaced or resurfaced. In several high traffic locations, the existing

### Erosion Protection Measures

**Bank Barbs** consist of approximately 100 cubic yards of large rock, placed at an upstream angle (see Figure II-11 on page 150). They affect downstream flow for approximately 100 feet, or four to five times their length (see Photo 11). Because they have little downstream impact and because they are eventually buried in aggrading rivers, such as the Stehekin River, barbs have a minimal effect on the river compared to other erosion protection or bank-hardening techniques such as rip-rap or levees.

Barbs increase river bank stability and capture wood and sediment coming downriver to the benefit of fish. Barbs also allow for safe raft passage and create pools that provide refuge to fish during floods.

**Grade Control Structures** are typically six feet wide by three feet deep and are several hundred feet long. These trenches are filled with large rock. They are designed to prevent rivers from cutting new flood channels along roads or trails, and are built perpendicular to the flow of water across a floodplain. The top of these structures does not protrude above the ground surface. As a result, they do not raise floodwater levels. Instead, they make floodwater spread out and stay shallow and slow moving. Grade control structures have been used successfully in the past at McGregor Meadows and along upper Company Creek Road.

**Bioengineering** is a riverbank slope-stabilization technique that consists of layering soil and riparian plants into an excavated bank between layers of coconut fiber matting that decomposes over time as the plants become established (see Figure II-12 on page 151). If given a few years to grow, these structures increase in strength over time (see Photo 11).

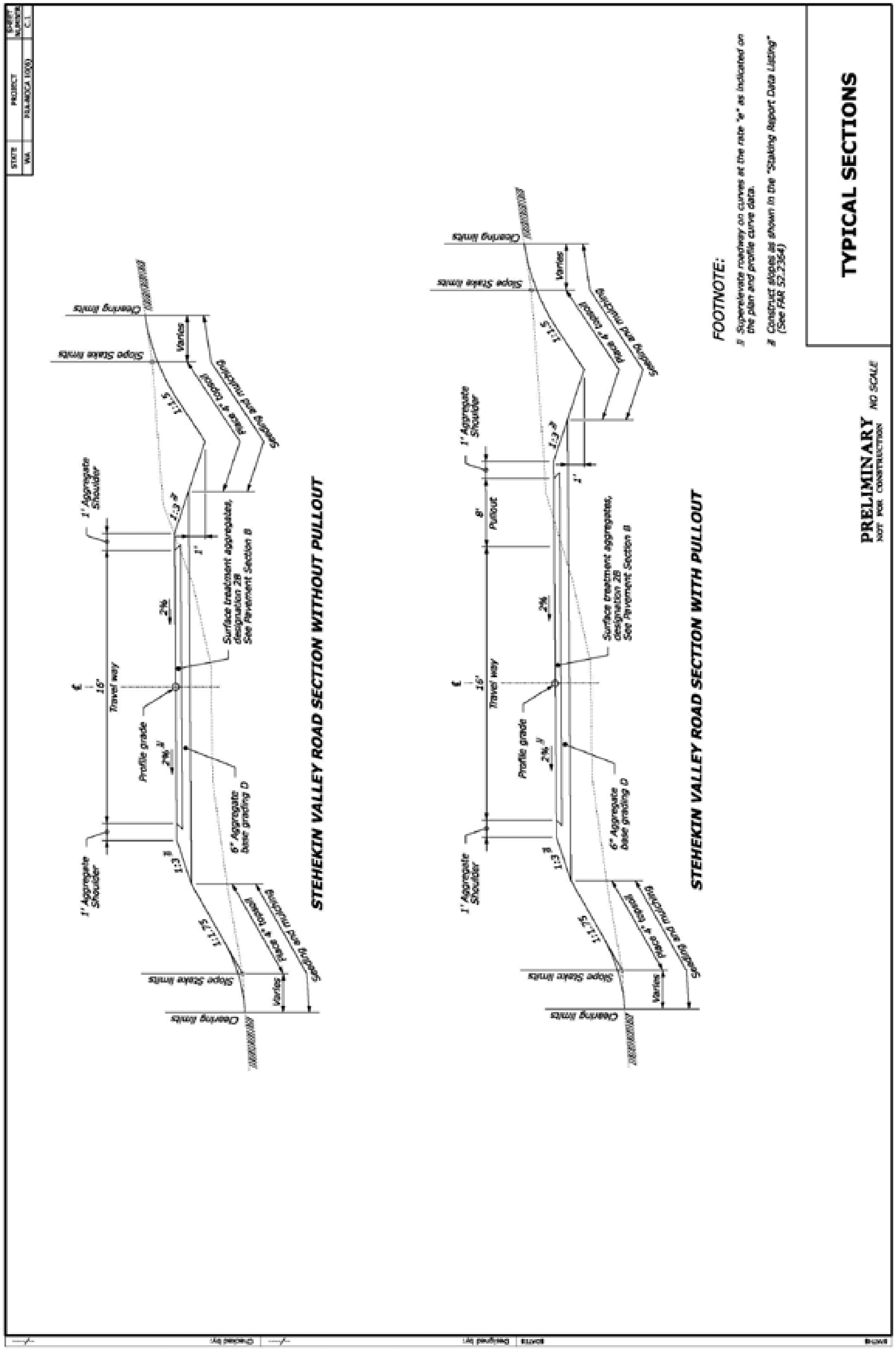
Plants would include dormant cuttings from red osier dogwoods (*Cornus sp.*), willows (*Salix sp.*), or other suitable species collected in the fall from nearby locations for wet areas, and stems of oceanspray (*Holodiscus sp.*) and wild rose (*Rosa sp.*) in drier areas.

Where needed, cuttings may be provided supplemental water through the first two summers.

**Riparian Restoration** is a technique that allows for return of natural bank stability and is proposed primarily in areas where native vegetation was removed for agriculture.

Riparian restoration also can be used alone or in combination with the installation of bioengineering, logs, or bank barbs.

## Figure II-8: Typical Road Cross Section and Cross Section with Pullout



roadway would maximize the use of the existing pavement (up to 20 feet in width) to maintain sight distance and to permit safer vehicle passage. In places where the road base is failing, the base and subgrade would be excavated and replaced with suitable material. New pullouts would improve safety by correcting sight distance problems caused by curves along the road. Other improvements would provide a uniform surface and improve driving and safety conditions for visitors, especially for large vehicles, including snowplows.

Culverts would be cleaned, replaced, or extended as needed. Additional culverts would be installed to correct drainage deficiencies. Road ditches and other minor features would be removed, replaced, repaired, or added, as appropriate, to correct drainage problems. Approximately 0.4 mile of new side ditches would be constructed and 3.6 miles of existing side ditches would be retained.

Vegetation clearing along the road would vary considerably, depending on location, according to whether or not a pullout is needed; whether or not alignment modifications are needed to improve sight distance; whether drainage ditches would need construction or reconstruction; and whether culverts were added, removed, or replaced.

## Road Surfacing

A new asphalt chipseal surface would be constructed under all alternatives. The existing road from the Landing to Harlequin Bridge would be resurfaced. The pavement would then be extended from the bridge to the northern terminus at the new winter turnaround and parking area. The new surface would cover the existing variable top-width. Where necessary, shoulder grades would be raised with compacted aggregate to the level of the new surface; and where appropriate, pavement markings would be applied to the surface of the road. Road signs would also be replaced and/or added as appropriate.

Photo 11 – Rock barb and willow layers (bioengineering) on upper Company Creek Road shortly after installation.

All work, except for the new pullouts and sight distance corrections, would be performed within the existing road prism. Surfacing would improve driving and safety conditions for vehicles, and allow for the existing designated travel speed of 25 miles per hour.

## Road Improvement Project Site-Specific Improvements

### *Wilson Creek Improvements (Stehekin Valley Road Milepost 5.3)*

Some of the Wilson Creek erosion protection improvements are common to Alternatives 1 - 5. At Wilson Creek there are drainage and/or erosion problems on both sides of the Stehekin Valley Road. On the south side of the road, the Stehekin River has eroded the bank along the toe of the road slope and there is a near-vertical drop of approximately 20 feet between the river and the road. In February 2004, cracks were observed that had developed along the side of the road shoulder, indicating the potential for future slope failure. Should this occur, portions of the road shoulder or the road itself would fail.

Wilson Creek is prone to periodic massive debris deposition on the roadbed. During high flows, the creek deposits large quantities of rock and gravel onto the road and into the culvert. It also tends to jump its bank during flooding, spreading out across the slope and causes water to flow across and erode the road in several places. This results in erosion of the road surface and additional destabilization of the riverbank.

Riverbank improvements proposed at this location include laying back the slope (reducing it) above the waterline for approximately 400 feet (this would generate approximately 1,100 cubic yards of material) and then stabilizing the slope (the method varies among alternatives) to allow native vegetation to reestablish.

After stabilization, the road would be rebuilt in place. All alternatives would re-grade the slope for approximately 400 feet, move the road laterally away from the river about 15 feet into the hillside, and install two new 60-inch culverts and a new ditch (NPS LACH 2005a:22 - 24). If the road becomes undermined, it would be rebuilt in place. No reroutes are possible given the location of the road along the edge of the bank and the steep adjacent terrain.

The slope is sparsely vegetated, and no large trees would be removed. Moving the road farther from the river would allow the shoreline room to adjust naturally over time and the slope to be stabilized and revegetated. It is likely the proposed solution would continue to require maintenance after big floods to remove gravel deposited on the road by Wilson Creek.

The new culverts would replace the current 36-inch culvert to reduce damage from heavy rains and flooding caused by Wilson Creek. In addition, a ditch would be constructed on the uphill side of the road to capture water from Wilson Creek and direct it to the culverts to minimize the potential for water running over the road surface.

Access across private property (approximately 1.5 acres) would likely be needed to implement Wilson Creek erosion protection. There is no access across NPS land; therefore, there is no room to work between the slope of the road and the Stehekin River. The NPS would work with the landowner to identify appropriate mitigation and/or compensation for impacts, such as an easement or purchase. If an easement could not be obtained, the road would be shifted into the hillside and would remain unpaved. This would likely extend the time before additional damage caused by the river occurs.

### *Winter Turnaround (Stehekin Valley Road Milepost 9.2)*

As called for by the Road Improvement Project, a winter vehicle turnaround and parking area for up to four passenger vehicles would be constructed. The turnaround area would be approximately 100 feet by 30 feet (0.07 acre). The turnaround would be the end of snowplowing in winter (NPS LACH 2005b:25).

# 7. Flood Protection Measures

## Public Facilities (McGregor Meadows Private Development / Company Creek Private Development)

The NPS would continue to respond to emergency conditions on an as-needed basis. Because gravel removal and additional levees have been dismissed from further consideration, the focus of floodplain management in this plan is on floodplain utilization, which allows floodwater to spread out and slow down during large events, thereby minimizing damage in any one part of the valley. Grade-control structures placed in the floodplain on both sides of the river near McGregor Meadows would be maintained as long as they are needed. These structures allow sheet flow of floodwaters through floodplains, consistent with floodplain utilization. This approach is widely considered the most sustainable for management of steep mountain rivers.

The NPS would also encourage Chelan PUD to keep the level of Lake Chelan as low as possible during spring and fall flooding periods (while remaining in conformance with lake level management to enable fish access to tributaries). Lake Chelan NRA would also continue to work with Chelan County to require raised drain fields for new construction in the channel migration zone and to advocate for modifications to existing drain fields that frequently flood and other actions to avoid development impacts in the channel migration zone, including additional pollutant contributions.

The NPS would not support attempts by individuals, local, state, or federal agencies to implement flood protection measures (e.g., dredging, dike, or levee construction) if such actions are deemed to detract from or otherwise impair the purpose and values for which Lake Chelan NRA was established.

## Technical Assistance to Stehekin Landowners

For development that remains within the floodplain, private landowners would continue to be encouraged to use “Advanced Flood Protection Measures” as outlined by the Army Corps of Engineers (ACOE) (Appendix 7), including elevating cabins and constructing ring dikes.

The NPS would provide Stehekin landowners with technical assistance for designing these recommended Advanced Protection Measures. The NPS would also encourage landowners to work with the county on implementing other measures to minimize water quality impacts associated with flooding of wells and septic systems. Staff would continue to be available to consult with Stehekin Valley landowners to implement these measures.

Some of the Advanced Protection Measures may require applicable landowner-obtained permits from Chelan County, the ACOE, and/or the Washington Department of Ecology, Washington

Department of Fish and Wildlife, and approval from the U.S. Fish and Wildlife Service. Among the measures contained in the packet of information include the following: flow deflector, ring dike, debris fence, grade control, and scour protection. Refer to Chapter VII: *Glossary and Acronyms* for explanation of each of these measures and Appendix 7: *ACOE Advanced Flood Protection Measures*.

## 8. Materials Sources, Construction, Staging, Restoration, and Mitigation/Monitoring

The following construction, staging, restoration and mitigation/monitoring conditions and requirements, derived from previous and ongoing work within the Stehekin Valley, would be common to all alternatives.

### Materials Sources

Road construction materials (gravel and rock) would be obtained from reject material within the Company Creek Pit in accordance with the *Sand, Rock, and Gravel Plan* (NPS LACH 1995e). Additional rock and gravel would be obtained from sources in the vicinity of Chelan and barged uplake to Stehekin Landing and then loaded into trucks to be hauled to project areas. Reliance on imported materials would be minimized by balancing cut and fill needs within the project area when reroutes are considered (Alternatives 2, 3 and 5) and by using material that has been determined to be unsuitable for other park needs from the Company Creek Pit.

As directed by the GMP, no sand, rock, or gravel would be removed from the Stehekin River floodplain. Other materials from the Company Creek Pit could be used if they meet the prescriptions in the Lake Chelan NRA *Sand, Rock, and Gravel Plan*, which specifically defines when and for what uses this material is available, which in general, is for emergency repairs or for ongoing maintenance needs.

Materials barged in from outside the area would be from an approved site that has been evaluated to ensure that it does not contain nonnative invasive plants (noxious weeds) and/or that treatment of affected areas has occurred before removal and/or before importation of materials. These “ancillary sites” would be approved by FHWA and NPS and would conform to the section entitled “Impacts Associated with Future Proposed Materials Sources, Staging or Spoils Areas” in Chapter IV: *Environmental Consequences*.

### Water Withdrawal Sites

The following water withdrawal sites could be used to obtain water needed for the road project in all alternatives: Lake Chelan (from deep water), Milepost 7 (straight section), Lower Field (straight section), Milepost 8, and Milepost 9.2. These sites have been evaluated for attendant impacts associated with access, including for wetlands and aquatic species. There would be no effect on wetlands, and negligible effects on water quantity and aquatic species. Except for the lake site, they are in fast-moving straight sections. Additional consultation would occur as timing and methods of water withdrawal are identified to ensure minimal impacts. These sites are also located along former rerouted sections of roadway where impacts of disturbance are still evident and where access to the Stehekin River varies from 15 to 300 feet. Over three months, about one million gallons of water could be used.

## Construction Staging

To the degree possible, construction staging would occur on existing sections of roadway to be abandoned or within otherwise disturbed areas (Company Creek Pit, Lower Field, and within proposed surfacing areas before the asphalt chipseal is applied). For the proposed project under all alternatives, major staging would occur at Company Creek Pit and Lower Field and within wide areas in the existing roadway. An area of approximately 3.3 acres would be available at the Lower Field. To minimize the potential for weed infestation, organic material would be removed prior to use and placed in a berm around the perimeter of the staging area. Staged materials would be covered, as appropriate, during storage to prevent weed contamination.

Staging areas for equipment and materials would also be in previously disturbed, park-approved locations, such as in existing pullouts. Additional staging for the reroutes in Alternatives 2, 3 and 5 would occur within the reroute areas. Staging areas would be protected from spillover impacts by the placement of erosion- and sediment-control barriers as appropriate and would be returned to preconstruction conditions or restored upon completion of the proposed project. Construction crews would stay at the Stehekin Landing Resort or private accommodations in the valley or in temporary housing in a previously disturbed site near the airstrip. Approximately ten to twelve temporary trailers could be used to house workers on site. These would be connected to a septic system constructed to county specifications for this purpose and which could later be used by the park for other needs. Placement of the trailers and access to them would require some vegetation clearing, however, this would be limited to the minimum needed and would not include expansion of the designated previously disturbed area. To avoid additional air pollution and other impacts, electrical connections to the Chelan Public Utility District system could be made and a diesel generator, therefore, would likely only be used as a back-up device.

## Rehabilitation of Abandoned Structures, Sites, and Facilities

As resources permit, the NPS would continue to remove flood-affected derelict structures on public land from the floodplain and to restore NPS-managed former areas of development. As properties with improvements are acquired or exchanged, the NPS would continue to remove buildings and utility system infrastructure and restore the sites to natural conditions to minimize contamination of the Stehekin River and to enhance aesthetics.

Among the kinds of structures and infrastructure that would be removed would be septic, electrical, and water systems, including septic tanks and drain field materials such as plastic infiltrators and conduit; electrical infrastructure such as power poles and lines; water system elements such as plumbing, well casings, and pumps. Foundations on concrete slabs or piers would also be removed. Where possible, these materials would be recycled or salvaged rather than removed to a landfill (outside Lake Chelan NRA). Where existing structures but not utility systems have been previously removed, NPS would return to remove infrastructure.

## Disturbed Area Rehabilitation and/or Restoration

As noted in the GMP:

> *The natural character of the lake and river edge on public lands (includes areas within 200 feet of the lake and river shoreline) would be restored. (NPS LACH 1995a:27 - 28)*

Site rehabilitation and/or restoration would occur as needed, subject to site conditions and available resources on lands where buildings and utility systems were removed. Restoration would also occur following construction of erosion protection measures, reroutes or rehabilitation of the existing roadway. As earthwork concludes, revegetation of disturbed areas would include topsoil replacement, planting and/or seeding. Topsoil and duff would be salvaged and applied to priority areas by the contractor as directed by Lake Chelan NRA staff.

Restoration would generally consist of the following activities:

- Prior to construction, site-specific and species-specific seed collection would occur along the length of the project area.
- The road contractor would complete earthwork (including scarification) according to contract documents to ensure adequate surface preparation for restoration/revegetation.
- Revegetation treatments would include mulching, transplanting, and hand seeding with native plants, as well as seed propagation and restoration treatments such as duff salvage, plant propagation, and planting.
- Revegetation would begin following completion of work in affected areas.
- The revegetation strategy would rely on natural regeneration from conserved topsoil and seed collected in the valley. Revegetation plantings would use native species that are slower to establish naturally and would be from genetic stock originating in the Lake Chelan NRA. The principal goal is to assist natural regeneration in reestablishing a sustainable native plant community similar to surrounding undisturbed vegetation.
- Revegetation would be monitored by park staff to ensure its successful establishment and would be in compliance with applicable permitting requirements.
- The primary revegetation areas would include obliterated sections of road and clearing limits along the reroutes. Additional areas of riparian restoration are also proposed within the alternatives.

## Mitigation Measures and Post-Project Monitoring

Where actions would be implemented by FHWA, FHWA would work in cooperation with the NPS to ensure the contractor complies with all mitigation measures identified for the proposed work to avoid or minimize impacts on Lake Chelan NRA resources during rehabilitation and construction activities throughout the duration of the project.

Mitigation Measures are summarized in Appendix 6 and would be implemented. To ensure that mitigation measures are followed, appropriate mitigation measures would be included in the appropriate Special Contract Requirements section, and with FHWA oversight, NPS staff would periodically conduct on-site inspection of construction activities and materials.

Following completion of the project, the NPS would monitor the success of revegetation treatments and supplement these with additional seeding or plantings if needed. For at least three years following project completion, the NPS would monitor for the presence of invasive plants. Invasive species would be removed as they are found during monitoring and through ongoing maintenance. Water quality would also be monitored before, during and for three years after project completion to ensure that mitigation measures meet their intended objectives.

## C. DETAILED DESCRIPTION OF DIFFERENCES AMONG ALTERNATIVES 1 - 5

This section describes the *differences* between the five alternatives. A brief overview of the project components that are treated differently by at least one alternative is described below. This is followed by a detailed discussion of how each component is treated by each alternative.

1. **Land Protection Plan Modifications:** Implementation of the LPP varies among alternatives. The existing 1995 LPP (NPS LACH 1995b) does not change under Alternative 1; it has been revised in the same way under Alternatives 2 and 3; and would be revised in a different way under Alternative 4; and still another way in Alternative 5. The priority ranking of private lands for Alternatives 2 and 3 is found in Appendix 11, for Alternative 4 in Appendix 12, and for Alternative 5 in Appendix 13. The criteria and scoring used to rank private lands for Alternatives 2 - 5 is found in Table II-5 on page 125.
2. **Stehekin Valley Road Modifications (Stehekin Valley Road Improvement Project Implementation):** The road would be raised and maintained in its current alignment under Alternatives 1 and 4, while different road reroutes to remove the road from the floodplain / channel migration zone in McGregor Meadows are proposed in Alternatives 2, 3, and 5.
3. **Stehekin Valley Road / Company Creek Road—Private Access:** In Alternatives 2 - 4, if major road failure occurs, a criteria-based decision-making process would be used to determine if the original access should be restored or a reroute should occur. In Alternative 5, a road connecting McGregor Meadows and the reroute would be constructed.
4. **Recreational Facilities:** In Alternative 1, existing facilities would be maintained and the Lower Valley Trail constructed. In Alternatives 2 - 5, there would be modifications of varying degrees made to add or change campgrounds. Construction of the Lower Valley Trail would vary slightly between Alternatives 1 and 4 and Alternatives 2, 3 and 5, as described in the preceding section. A new river access point and access road near the river mouth would also be constructed in Alternatives 2, 4 and 5.
5. **Management of Large Woody Debris:** In Alternative 1, large woody debris would be manipulated only to protect public roads and bridges, and individual logs would continue to be trimmed or turned for safer recreational use. Floating woody debris could continue to be collected from the head of Lake Chelan after floods. Alternatives 2 - 5 would allow for collection from the tops of some logjams in the lake backwater zone for use in erosion protection measures and restoration. In Alternative 4, the collection zone would extend farther. Woody debris could be made available to private landowners for streambank restoration and erosion protection projects under specific conditions in Alternatives 2 - 5.
6. **Flood Protection Measures:** In Alternatives 2 - 5, land exchanges or acquisition to remove development from the floodplain would be emphasized to allow the Stehekin River to spread floodwater across its floodplain. A portion of the Stehekin Valley Road would be rerouted out of the floodplain / channel migration zone in Alternatives 2/5 and 3 (two different reroutes). Grade control structures would provide some reinforcement to the existing road in lower McGregor Meadows in Alternative 5.
7. **Interpretation and Education:** In Alternatives 1 - 5 existing interpretive programs would continue. Under Alternatives 2 - 5, enhanced interpretation emphasis on the value of large

woody debris in the river environment, the role of flooding in river ecosystems, on the value of minimizing human impacts to river systems, on river processes, and the sensitive and flood-prone nature of the Stehekin River would occur.

8. **Research and Monitoring:** Under all alternatives, the NPS would continue existing research and monitoring programs, focused on large woody debris, main and side channel habitat, water quality, hydrology, fish surveys, historical research and analysis, nonnative/invasive plants, climate change effects, and special status species research. In Alternatives 2 - 5 the NPS would expand research and monitoring programs to determine the effectiveness / consequences of erosion and flood protection measures, large woody debris manipulation, etc. and would add more flow gauges on the upper river if funding is available.

9. **Weaver Point Erosion Protection Measures:** In all alternatives, actions called for under the Federal Energy Regulatory Commission (FERC) relicensing Environmental Assessment (constructing a lake shoreline logjam and rock wall and developing cultural resources management plans) would occur. In Alternatives 1, 2 and 5 some campsites would be moved away from the eroding riverbank east of the docks. In Alternatives 3 and 4, two rock barbs and bioengineering would be constructed and the FERC logjam extended to stabilize the bank and to protect the campground from future erosion.

10. **Stehekin River Mouth Erosion Protection Measures:** No actions would be taken under Alternative 1 to remove rip-rap on public land and restore the stream bank, or to prevent potential river channel changes that could ultimately threaten the Stehekin Valley Road. In Alternatives 2/5 and 4, rock barbs, a small logjam, and bioengineering would replace a portion of the rip-rap (on NPS land). In Alternative 3, a large engineered logjam would replace the rock barbs and bioengineering proposed in Alternatives 2/5 and 4.

11. **Stehekin Valley Road Erosion Protection Measures:** In Alternatives 2 - 5, a series of erosion protection measures (including engineered logjams and/or rock barbs and bioengineering) would protect the Stehekin Valley Road. Fewer of these same measures would occur in Alternatives 2 and 3 because of the proposed road reroutes. There would be actions in four locations in Alternatives 2/5, six in Alternative 3, and eight in Alternative 4.

## 1. Land Protection Plan Modifications

**Background:** National parks containing private lands are required to have LPPs (see “Land Protection Plans (LPP)” on page 119). The 1995 Lake Chelan NRA LPP (NPS LACH 1995b) consists of management objectives, compatibility criteria, ranking criteria, and priorities that direct NPS land exchanges and acquisition of private parcels. The priorities are based on park-identified resource criteria and on legal authority (see “Authority for Land Exchanges” on page 120).

**Management Objectives:** Eight management objectives were identified to meet the overall goal of ensuring that land uses on public and private lands are compatible with the purpose of Lake Chelan NRA. Fourteen guidelines form the basis for implementing the plan (see Appendix 3: *Lake Chelan NRA Land Protection Plan Management Goals / Objectives and Guidelines*).

**Compatibility Criteria:** Compatibility criteria assist in determining how uses contribute to or detract from the purposes of Lake Chelan NRA (Appendix 3). “The alteration, development, and use of all public and private properties within Lake Chelan NRA must comply with . . . and must

**Land Protection Plans (LPP)**

The purposes of a LPP for a unit of the National Park System are to:

1. Determine what land or interests in land need to be in public ownership and what means of protection other than fee acquisition are available to achieve unit purposes as established by Congress.

2. Inform landowners about NPS intentions for buying or protecting land through other means within the unit.

3. Help managers identify priorities for making budget requests and allocating available funds to protect land and unit resources.

4. Find opportunities to help protect the unit by cooperating with state or local governments, landowners, and the private sector. (NPS LACH 1995b:1)

LPPs establish priorities for the exchange/acquisition of, or government interest in, private lands. Within an LPP, all private lands within a national park unit are classified regardless of actual intent or means to acquire them. All transactions are based on a willing seller/willing buyer arrangement.

be compatible with the congressionally designated purposes of Lake Chelan NRA" (NPS LACH 1995b:13).

**Priorities:** All private lands within Lake Chelan NRA were classified in the LPP in terms of priority for exchange/acquisition, regardless of actual intent or means to acquire them. These priorities were ranked high, moderate, and low (see Table II-3: *1995 Land Protection Plan Ranking of Private Lands*). This allowed the 1995 LPP to then identify the acres targeted for exchange based on a system of resource-based criteria. Changes in the floodplain boundaries from large floods in 1995, 2003, and 2006 have altered conditions on many private parcels.

**Table II-3: 1995 Land Protection Plan Ranking of Private Lands**

| Priority | Proposed Minimum Interest | Number of Tracts | Acres |
|---|---|---|---|
| High | Fee | 1 | 0.77 |
| | Easement | 43 | 99.45 |
| | Combination | 18 | 272.04 |
| Moderate | Fee | 7 | 3.69 |
| | Easement | 11 | 17.60 |
| | Combination | 0 | 0 |
| Low | Fee | 43 | 23.37 |
| | Easement | 43 | 19.06 |
| | Combination | 0 | 0 |

## Existing (Alternative 1) LPP Ranking Criteria and Proposed Acquisition and Exchange Lands

Nonfederal land was evaluated for the presence of certain resource values, including wetlands, high flood influence areas, riparian communities, and areas of high visual sensitivity. The criteria also identified lands in visually sensitive sites along public roads (NPS LACH 1995b:27).

Once these criteria were applied to all nonfederal lands, these same criteria and others were applied to determine whether potential exchange lands had high resource value, identified by the 100-year floodplain, wetland soils, geohazard areas, slopes greater than 20 percent, and/or areas of high visual sensitivity (NPS LACH 1995b:16).

After application of both sets of criteria, the following ranking based on parcel size was applied to determine the final ranking.

- **Low:** Tracts less than one acre (85 total). Due to small size, the potential for significant impact on resource values is far less than for tracts greater than one acre.
- **Moderate:** Tracts greater than one acre, with high-priority resources for protection over less than 50 percent of the area (17 total).
- **High:** Tracts greater than one acre, with high-priority resources over more than 50 percent of the area (64 total) (NPS LACH 1995b:27).

The 1995 LPP ranked 167 private tracts, comprising approximately 460 acres, as shown in Table II-3 (NPS LACH 1995b:iii).

### Authority for Land Exchanges

Public Law 90-544, title III, Section 301 authorized Lake Chelan NRA to acquire and exchange lands (see "C. Relationship to Other Plans" in Chapter I: *Purpose of and Need for Management Action*). The 1995 LPP consists of priorities, management objectives, and ranking criteria to direct NPS land exchanges for private parcels.

To allow for exchange of federal lands for private lands, the 1995 LPP defined when exchanges could occur: when the private lands have a high resource value and the public lands have a low resource value (NPS LACH1995c:35). The four resources of concern identified in the 1995 LPP included wetlands, high flood influence areas, riparian communities, and high visual sensitivity areas (NPS LACH 1995c: 27).

> *The secretary of the interior has the authority to exchange federally owned property , or interests therein, which has been determined to be suitable for exchange, or other disposal, for nonfederal property within Lake Chelan NRA. . . Exchange properties will be limited to certain selected federal lands that have been acquired since the establishment of the Lake Chelan NRA in 1968. Federal lands acquired since 1968 total 1,173 acres. In addition to the proposed exchange possibilities described below, future acquired properties may be subsequently considered for disposal by exchange after two years from the date of acquisition in order to enhance historic or traditional development patterns; consolidate new forms of approved development proposals into the most suitable areas; or protect areas of higher resource values.*
>
> *All potential exchanges will be based on near equal value for value real estate appraisals, not acre for acre, and may be limited by the availability of appropriated funds if the nonfederal lands exceed the value of the federal lands to be exchanged.*

The ranking for specific private lands within Lake Chelan as classified by the 1995 LPP is found in Table 2: *Priorities for Protection and Proposed Minimum Interest* in the 1995 LPP (NPS LACH 1995b:31 - 34), which is duplicated in the Stehekin River Corridor Implementation Plan (SRCIP) in Appendix 10: *1995 Land Protection Plan Ranking of Private Lands*.

## Actions Taken Since the 1995 Land Protection Plan

As noted earlier, the 1995 GMP and LPP called for moving private development out of the floodplain as the most viable solution to minimize flood damage to private property and resources. Of the more than 62,000 acres that then comprised Lake Chelan NRA (including lands within the boundary owned by other entities), the 1995 LPP identified 1,173 acres of land acquired by Lake Chelan NRA upon or after its establishment in 1968 (and owned in fee). These lands were therefore determined to be potentially available for exchange because they had at some point been privately owned (outside the public domain).

Of the 1,173 acres, 1,123 acres were determined to have high resource value in the 1995 LPP and were identified for retention by Lake Chelan NRA because they had one or more of the development constraints or four resources of concern identified in the LPP (see sidebar "Authority for Land Exchanges"), because they were part of historic properties, or because they could be used for visitor facilities at the Landing. This left approximately 50 acres that could potentially be exchanged with Stehekin landowners to meet the objectives of protecting high resource value lands and/or moving critical residential development out of the Stehekin River floodplain. Those 50 acres that were suitable at the time for exchange were made available pending "appropriate deed reservations … to ensure compatible use subsequent to the exchange" (NPS LACH 1995b:36).

In the 1995 LPP, "although private lands in the valley could be exchanged for public lands outside the recreation area, this possibility" was "considered beyond the scope of" that plan. Nonetheless, the LPP went on to state: "If landowners show interest on a willing seller / willing buyer basis, the National Park Service would work with the Bureau of Land Management and other federal agencies under the Federal Land Exchange Act of 1988, to determine if federal lands outside the recreation area would be available for exchange" (NPS LACH 1995b:35).

Since 1995, the NPS has completed two land exchanges (12.75 acres) from the identified 50 acres available for exchange, leaving approximately 37 acres still available (see Table II-4: 1*995 Land Protection Plan Proposed Exchange Parcels*) (NPS LACH 2005c:36). Some of this land, however, may no longer be suitable due to new information regarding resource significance or changes in conditions related to flooding. Areas that may no longer be suitable include one combined parcel (1.34 acres) mostly within the floodplain without enough buildable area, and the Lower Field (19.2 acres) which is known habitat for northern spotted owls, elk, deer, bears, and other wildlife. Because the LPP has not been updated until now, however, these lands remain "currently available" for exchange. (They are included in the "no-action" Alternative 1 to facilitate comparison with the other alternatives.)

Since 1995, the NPS has also acquired six tracts (totaling roughly 30 acres); acquired easements or deed restrictions on several other parcels (roughly 20 acres); and completed a boundary adjustment along Lake Chelan based on a property survey that resulted in a deletion of approximately 23 acres from the Lake Chelan NRA (the original survey line had been drawn inaccurately).

**Table II-4: 1995 Land Protection Plan Proposed Exchange Parcels**

| Area | Acres Available |
|---|---|
| Vicinity of Lower Field | 21 |
| Little Boulder / Boulder Creek (both sides of the road) | 16 |
| East of the Airstrip | 6 |
| Vicinity of Stehekin Valley Ranch | 5 |
| Above Rainbow Creek (west side of the road) | 2 |

There were originally 167 tracts (totaling 460 acres) of privately owned land identified in the 1995 LPP, plus a mixture of Washington State, Chelan County Public Utility District #1, and Stehekin School District lands (totaling roughly 2,273 acres). There are now 168 privately owned tracts totaling 416.8 acres. (The number of tracts has increased due to the actions of some landowners splitting existing tracts into more than one tract or combining some tracts into a larger parcel, and the splitting of some tracts into two tracts to account for easements established with the NPS.) Updated information on the mixture of state, Chelan PUD, private land, and Stehekin School District lands now indicate those lands total roughly 2,613 acres.

## Treatment of the Land Protection Plan by Alternative

### *Land Protection Plan Modifications*

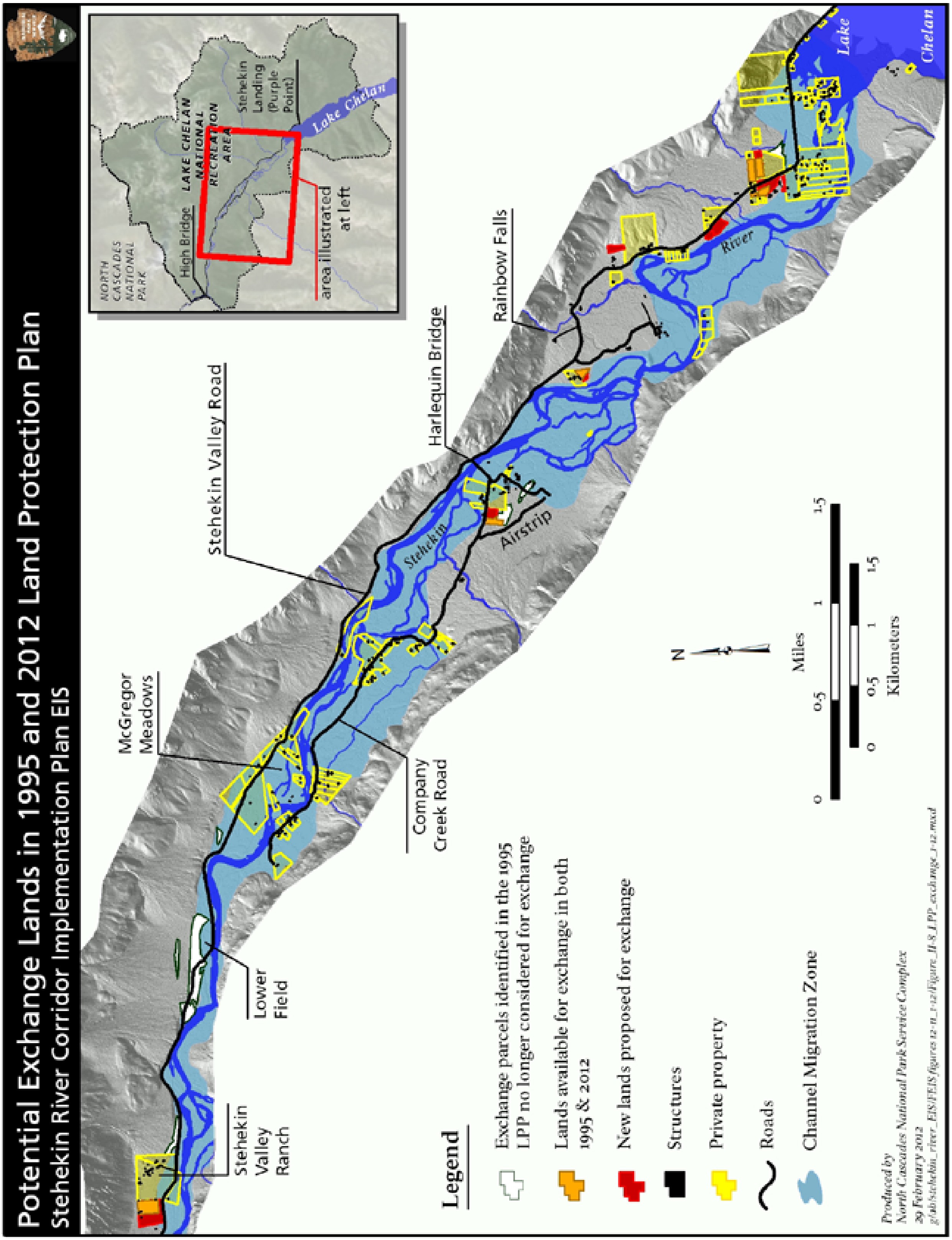
#### Elements Common to Alternatives 2 - 4

Although LPP priorities would be different among alternatives, the key purposes of the LPP would be the same as in Alternative 1. Lands that would remain in public ownership and lands available for exchange would be the same under Alternatives 2 - 4. These potential exchange lands are located on alluvial fans and other landforms outside the channel migration zone. Some exchange parcels have also been identified where they would augment a cluster of existing development. Prioritization of private lands for acquisition, however, varies between Alternatives 2 and 3 and Alternative 4, to reflect slightly different approaches to floodplain management, particularly in McGregor Meadows. Alternatives 2 and 3 emphasize removal of more private parcels from the channel migration zone than Alternative 4. Alternative 4 gives lower priority scoring to parcels in the channel migration zone and near the river channel. See Appendix 11 for the priority ranking of private lands for Alternatives 2 and 3, and Appendix 12 for the priority ranking of private lands for Alternative 4.

#### Alternative 5

All but two parcels available for exchange would be the same as in Alternatives 2 - 4. Alternative 5 would have one additional exchange parcel (0.6 acres) available only for agricultural use. It would also increase the amount of land available for exchange above the Stehekin Valley Ranch. Prioritization of private lands for acquisition would vary in Alternative 5 to focus on the most vulnerable areas that could be affected by flooding. As in Alternatives 2 and 3, Alternative 5 would encourage more removal of unsustainable development from the channel migration zone than Alternative 4. Alternative 5 would give higher priority to parcels in deposition zones (McGregor Meadows and the head of the lake) and on active parts of debris cones than Alternatives 2, 3 or 4.

**Figure II-9: Potential Exchange Lands in 1995 and 2012 Land Protection Plan**



Alternative 5 also takes into consideration scenic values at the head of Lake Chelan. Appendix 13 shows the ranking of private lands in Alternative 5.

### *Land Protection Plan Implementation*

#### Alternative 1

Under Alternative 1, implementation of the 1995 LPP (NPS LACH 1995b) would not change. The purposes, management objectives, compatibility criteria for public and private lands, land protection techniques, and land protection priorities as identified in that plan would remain the same (Table II-4: *1995 Land Protection Plan Proposed Exchange Parcels*).

#### Elements Common to Alternatives 2 - 5

**Land Protection Plan Ranking Criteria (to determine priorities):** The 1995 Lake Chelan LPP criteria to identify lands of high resource value have been revised in Alternatives 2 and 3 and Alternative 4 and somewhat differently in Alternative 5 to reflect a new emphasis on removing development from the channel migration zone, not just the floodplain, as was done in the 1995 LPP (NPS LACH 1995b). There is also increased emphasis placed on clustering new development in areas away from the river, despite potentially being visible to the public. Therefore, the focus on the Stehekin River migrating within its natural channel migration zone necessarily redirects some of the LPP criteria away from protecting scenic resources and more toward avoiding the river. Because the NPS remains concerned about the aesthetic qualities of development in the lower valley, appropriate Conditions, Covenants and Deed Restrictions (CCRs) (Appendix 9) would continue to ensure that exchange lands remain visually compatible with the rustic vernacular characteristics of the Stehekin Community and the purposes of Lake Chelan NRA. The NPS would also continue to apply these same general standards to public and administrative facilities. Unlike Alternatives 2 - 4, Alternative 5 retains a criterion that focuses on scenic characteristics.

Since the passage of the three largest floods on record in the last 16 years, consideration of land protection priorities has changed, although many remain the same. The focus in Alternatives 2 - 5 is on removing development threatened by the river and on planning for future river changes. Other development effects, such as the unsuitable locations of septic drain fields and structures (with the potential to be inundated and/or incorporated into the river, with resultant adverse effects on water quality and scenic resources) have also been considered.

Under Alternatives 2 - 5, new LPP criteria would be adopted to acknowledge the changing conditions related to recent massive flooding in the lower Stehekin Valley. This list of criteria would be applied differently in Alternatives 2 and 3, compared to Alternative 4 and Alternative 5 (see descriptions of Alternatives 2 - 5 below) (Table II-5). The criteria are used to determine what lands should have the highest priority for protection within Lake Chelan NRA and would revise the similar list of criteria in the 1995 LPP identified in Alternative 1 (Table II-5: *Proposed Land Protection Plan Criteria Weighting for Alternatives 2 - 5* ).

**Lands Available for Exchange:** Approximately 24 acres would be available for exchange in Alternatives 2 - 4 and 29 acres in Alternative 5, although this could increase by a few acres if development of the NPS maintenance (Alternatives 1 -5) and housing (Alternatives 1 -4) in the airstrip area requires less acreage than anticipated (Table II-6: *Alternatives 2 - 5 Revised Land Protection Plan Proposed Exchange Parcels*). Although initial review of park-owned (fee) lands

**Table II-5: Proposed Land Protection Plan Criteria Weighting for Alternatives 2 - 5**

| Criteria | Alternatives 2 and 3 | Alternative 4 | Alternative 5 (Preferred) |
|---|---|---|---|
| **Stehekin River channel migration zone (CMZ)** | **2 points**: Structure within CMZ and/or if less than one acre of property is outside the CMZ<br>**1 point**: No structure within CMZ and greater than one acre of property is outside CMZ<br>**0 points**: Entire parcel outside CMZ | **1 point**: Structure within CMZ and/or less than one acre of property is outside CMZ<br>**0 points**: No structure within CMZ and greater than one acre of property outside CMZ | **10 points**: Overnight dwelling within McGregor Meadows CMZ in deposition zone (urgent zone 1)*<br>**8 points**: Overnight dwelling within McGregor Meadows CMZ in deposition zone (urgent zone 2)*<br>**6 points**: Overnight dwelling within McGregor Meadows CMZ in deposition zone (urgent zone 3)*<br>**5 points**: Overnight dwelling within McGregor Meadows CMZ in deposition zone (urgent zone 4)*<br>**5 points**: Overnight dwelling within Stehekin River Mouth CMZ in deposition zone (urgent zone 4)*<br>**4 points**: Overnight dwelling within other CMZ deposition zone<br>**3 points**: Overnight dwelling within CMZ but not in deposition zone<br>**2 points**: No overnight dwelling in CMZ deposition zone on > 2.5 acres<br>**1 point**: No overnight dwelling in CMZ on 2.5 acres<br>**0 points**: No overnight dwelling, out of CMZ or in CMZ on <2.5 acres |
| **Alluvial fan migration zone (AFMZ) of Boulder, Company, or Rainbow Creek** | **2 points**: Structure within AFMZ and/or less than one acre of property is outside AFMZ<br>**1 point**: No structure within AFMZ and greater than one acre of property is outside AFMZ<br>**0 points**: Entire parcel outside AFMZ | **1 point**: Structure in AFMZ and/or less than one acre of property outside AFMZ<br>**0 points**: No structures within AFMZ | **2 points**: Overnight dwelling in AFMZ<br>**1 point**: No overnight dwelling in AFMZ on >2.5 acres<br>**0 points**: No overnight dwelling in AFMZ on <2.5 acres |

| Criteria | Alternatives 2 and 3 | Alternative 4 | Alternative 5 (Preferred) |
|---|---|---|---|
| **Presence of structures in a Debris Cone Hazard Zone (DCHZ)** | N/A | N/A | **10 points**: Overnight dwelling in defined DCHZ<br>**6 points**: No overnight dwelling in DCHZ but property has hazard zone on it and >2.5 acres<br>**0 points**: No overnight dwelling in DCHZ and property has <2.5 acres undeveloped |
| **Wetlands or riparian habitat** | **1 point**: Wetlands or riparian habitat present<br>**0 points**: No wetlands or riparian habitat | **1 point**: Wetlands or riparian habitat present<br>**0 points**: No wetlands or riparian habitat | Same as Alternative 2 |
| **Rare species or suitable habitat for those species** | **1 point**: Rare species or habitat present<br>**0 points**: No rare species/ habitat present | **1 point**: Rare species or habitat present<br>**0 points**: No rare species/ habitat present | Same as Alternative 2 |
| **Potential to reduce habitat fragment-tation** | **2 points**: Parcel greater than five acres and adjacent to public land<br>**1 point**: Parcel less than five acres and adjacent to public land<br>**0 points**: Parcel not adjacent to public land | **2 points**: Parcel greater than five acres and adjacent to public land<br>**1 point**: Parcel less than five acres and adjacent to public land<br>**0 points**: Parcel not adjacent to public land | **6 points**: Undeveloped block > 20 acres<br>**4 points**: Undeveloped block of 10-20 acres<br>**2 points**: Undeveloped block of 5-10 acres<br>**0 points**: Undeveloped block <5 acres |
| **Potential for public use/access** | **1 point**: Parcel adjacent to public land used for administrative use or has potential for public use<br>**0 points**: No administrative use or potential for public use adjacent to parcel | **2 points**: Parcel adjacent to public land used for administrative use or has potential for public use<br>**0 points**: No administrative use or potential for public use adjacent to parcel | N/A |
| **Cultural resources or related concerns** | **1 point**: Parcel has known cultural resources<br>**0 points**: No cultural resources present | **1 point**: Parcel has known cultural resources<br>**0 points**: No cultural resources present | Same as Alternative 2 |
| **Permanent structures** | **2 points**: Parcel has a permanent structure<br>**1 point**: Parcel has no permanent structures | **1 point**: Parcel has a permanent structure<br>**0 points**: Parcel has no permanent structures | N/A |

| Criteria | Alternatives 2 and 3 | Alternative 4 | Alternative 5 (Preferred) |
|---|---|---|---|
| **Urgency of threat to develop-ment** | **2 points**: Parcel has structure less than 50 feet from main or major side channel of Stehekin River<br>**1 point**: Access road to parcel is less than 50 feet from main or major side channel of Stehekin River<br>**0 points**: Entire parcel and access road greater than 50 feet from main or major side channel and/or no structures located on property | **1 point**: Parcel has structure less than 50 feet from main or major side channel of Stehekin River<br>**0 points**: Parcel has access road less than 50 feet from main or major side channel of the Stehekin River and/or no structure located on property | This issue was combined with the Channel Migration Zone criterion above. |
| **Visual Sensitivity** | N/A | N/A | **4 points**: Parcel visible from all three key viewpoints (Landing, First Mile of SVR, Lake Chelan)<br>**2 points**: Parcel visible from two viewpoints<br>**1 point**: Parcel visible from one viewpoint<br>**0 point**: Parcel not visible from any of three key viewpoints |

**Urgent Zones are described in the 2012 LPP. The four priority zones ("Urgent Zones 1 - 4"), relate to the urgency of the threat, with Urgent Zone 1 representing the area most at risk and Urgent Zone 4 the least at risk within the McGregor Meadows area. The second highest weight was given to the river mouth deposition zone, and the least weight to other lower valley deposition zones, where the river has more room to flood and migrate than at the river mouth or McGregor Meadows. These zones are shown in Figure 18 in the LPP.*

### Table II-6: Alternatives 2 - 5 Revised Land Protection Plan Proposed Exchange Parcels

| Area | Alternatives 2 - 4 Acres | Alternative 5 (Preferred) Acres |
|---|---|---|
| Above Stehekin Valley Ranch | 5.2 | 10.2 |
| Near airstrip (former Peterson property) | 2.0* | Same as Alternatives 2 - 4 |
| West of Rainbow Falls (former Webb property) | 1.33 | Same as Alternatives 2 - 4 |
| Near Stehekin School (former Rice property) | 1.68 | Same as Alternatives 2 - 4 |
| Boulder Creek area (former Griffin/Getty property) | 3.79 | Same as Alternatives 2 - 4 |
| Boulder Creek area (former Brownfield property) | 2.61 | Same as Alternatives 2 - 4 |
| Keller's Park | 7.2 | Same as Alternatives 2 - 4 |
| Corral area (near Bakery) | N/A | 0.6 acres |
| **Total** | 23.81 | 29.41 |

**Up to ten additional acres could be added to this site following completion of the development plan for the NPS maintenance and housing facility identified here and in the GMP.*

resulted in approximately 76 acres that were potentially suitable for exchange consideration, further resource analysis and field reconnaissance resulted in the reduction of this acreage to the approximately 24 acres that are proposed as being available under Alternatives 2 - 4 for exchange and the 29 acres identified in Alternative 5.

Parcels have been identified for potential exchange based on evaluation of the above resource criteria as applied to formerly private lands acquired in Lake Chelan NRA. Because this implementation plan is an update to the 1995 GMP and its associated LPP, the guidance from these plans to determine which lands are available for disposal or exchange is part of this revised LPP. As noted earlier in the quote from the 1995 LPP, lands that have always been within the public domain are not able to be exchanged, including lands transferred from other agencies of the federal government, such as the U.S. Forest Service (USFS), and/or lands that were once part of one of the surrounding historic Forest Reserves. In summary, the NPS has not determined (through the GMP or previous LPP planning) any lands that have always been in the public domain as suitable for disposal, including exchange.

As in Alternative 1, lands identified for exchange would be conveyed with Conditions, Covenants and Deed Restrictions (CCRs) to ensure that subsequent private development remains compatible with Lake Chelan NRA and the Stehekin Community. Each parcel identified for exchange would be ground-truthed to tailor the CCRs to the specific conditions of the property and would be subject to future environmental analysis. Easements or terms and conditions for development would be identified to fit the topography, vegetation, visibility, and character of existing or potential developments on each tract (NPS LACH 1995b:21). See Appendix 9: *Proposed Conditions, Covenants, and Deed Restrictions* for a list of potential criteria that would be applied as part of land exchanges, where applicable.

Such provisions would protect Lake Chelan NRA resources by specifications related to:

- Clearing of vegetation;
- Location and design of new access roads and utilities;
- Density, height, design and color of development visible to the public; and
- Access for management of natural and cultural resources. (NPS LACH 1995b:21).

The NPS envisions that some individual parcels available for exchange may be desired by multiple landowners seeking exchange. It is conceivable that given the heightened concerns associated with the increasing flood magnitude and frequency on the Stehekin River, the NPS's continued desire to pursue land exchanges as a means of land and resource protection, the limited availability of federal funding to complete land exchanges, and the limited availability of potential federal lands for exchange, there may be interest from multiple landowners in pursuing exchanges or multiple landowners interested in exchanging for the same federal parcel.

To ensure there is a fair, objective, and transparent process for determining who should be given priority for exchange, the NPS proposes to consider the following criteria when multiple landowners are interested in a particular parcel:

Primary criteria:

- The landowner's current parcel is a priority in the acquisition ranking described above (high, medium, or low).

- The landowner is willing to consider other ways to equalize values, including paying for costs associated with structure removal on their current parcel, or considering an unequal trade.
- The landowner is willing to comply with CCRs to protect resources.
- The landowner is willing to consider clustering development or sharing utilities as a means of reducing the overall development footprint.

Secondary criteria:

- The timing of the request for exchange (a request for a parcel made months before others may be considered first).
- The landowner is willing to help defray due diligence costs, such as appraisals, surveys, and environmental site assessments.

### Alternative 5: Land Protection Plan Implementation Differences

**Land Protection Plan Ranking Criteria (to determine priorities):** As in Alternatives 2, 3 and 4, the 1995 Lake Chelan LPP criteria to identify lands of high resource value have been revised in Alternative 5 to reflect a new emphasis on removing development from the channel migration zone, not just the floodplain and increased emphasis on clustering new development away from the river. Alternative 5 takes this one step further by focusing on the most vulnerable areas. As in Alternatives 2, 3, and 4, appropriate CCRs would continue to ensure that exchange lands remain visually compatible with the rustic vernacular characteristics of the Stehekin Community and the purposes of Lake Chelan NRA, however Alternative 5 would also include a criteria for scenic qualities, similar to the 1995 LPP.

As in Alternatives 2 - 4, new LPP criteria would be adopted to acknowledge the changing conditions related to recent massive flooding in the lower Stehekin Valley. A different but similar list of criteria would be applied in Alternative 5 (Table II-5). As in other alternatives the criteria would be used to determine what lands should have the highest priority for protection within Lake Chelan NRA and would revise the similar list of criteria in the 1995 LPP identified in Alternative 1 (Table II-5: *Proposed Land Protection Plan Criteria Weighting for Alternatives 2 - 5*).

The following eight criteria would be used to rank lands in Alternative 5:

1. Location of an overnight dwelling within an active channel migration zone on the floodplain (CMZ) and/or deposition zone of the Stehekin River.

   The presence of an overnight structure is important because the incorporation of cabins, drain-fields, and septic tanks into the river during a flood is a major threat to the community, water quality, and scenic resources. This characteristic also applies to criteria 2 and 3 below.

   For those properties in deposition zones, the greatest weight (most number of points) was given to the McGregor Meadows area because of rapid gravel accumulation, bank erosion, flooding, channel changes, and high potential for additional rapid change during large floods. This area was further analyzed by recognizing four priority zones ("Urgent Zones 1 - 4"), which relate to the urgency of the threat, with Urgent Zone 1 representing the area most at risk and Urgent Zone 4 representing the area least at risk within the broader McGregor Meadows area. The second greatest weight was given to the river mouth deposition zone, and the least weight was given to other lower valley deposition zones where the river has more room to flood and migrate than at the river mouth or McGregor Meadows.

2. Location of an overnight dwelling or potential for development within an active tributary alluvial fan channel migration zone (AFMZ).
3. Location of an overnight dwelling or potential for development within a debris cone hazard zone (DCHZ).
4. Large undeveloped parcels. Larger parcels without current development represent the greatest risk of habitat fragmentation within the valley.
5. Presence of wetlands and/or riparian habitat, based on mapping completed in 1986. These habitats are defined by the US Fish and Wildlife Service as "lands transitional between terrestrial and aquatic systems where water is usually at or near the surface or the land is covered by shallow water." A site is a wetland if it contains one or more of three diagnostic characteristics: vegetation, soil characteristics of wet areas, and at least the seasonal presence of water. Riparian zones represent a type of wetland that includes the diverse vegetation along the active river channel, tributaries, and side channels.
6. Presence of protected plant and animal species habitat, including federal and state threatened, endangered, rare, or candidate species; species of special interest, including locally sensitive species; and unique, rare, or high diversity habitat.
7. Presence of a cultural resource or related concern.
8. Location along the shore of Lake Chelan. This area has the highest visual sensitivity in Lake Chelan NRA. This criterion is not used in the overall resource analyses to establish High-Medium-Low priorities for each tract, but rather is used to establish scenic easement priorities for tracts visible along the lakeshore. The points associated with this criterion are included in Appendix D.

**Lands Available for Exchange:** In addition to the 24 acres identified in Alternatives 2 - 4, another small (0.6 acre) parcel would be available for exchange to maintain its agricultural use, and the proposed exchange parcel above the Stehekin Valley Ranch has been increased by roughly five acres. Other actions identified above for Alternatives 2 - 4 would also be the same in Alternative 5. Elements Common to Alternatives 2 and 3: Land Use Protection Priorities

**Land Use Protection Priorities:** High, medium and low priorities would vary by alternative; see descriptions in Alternative 2 (Alternative 3 would be the same) and Alternative 4 (Table II-7: *Comparison of LPP Priorities for Private Lands in Alternatives 2 - 5*).

**Table II-7: Comparison of LPP Priorities for Private Lands in Alternatives 2 - 5**

| Tentative Priority | Alternatives 2 and 3 | | Alternative 4 | | Alternative 5 | |
|---|---|---|---|---|---|---|
| | Number of Tracts | Acres | Number of Tracts | Acres | Number of Tracts | Acres |
| High | 66 | 271.50 | 15 | 137.03 | 31 | 189.62 |
| Medium | 98 | 141.22 | 81 | 236.30 | 72 | 148.84 |
| Low | 4 | 4.75 | 72 | 54.14 | 65 | 78.34 |

Under the revised LPP the remaining 168 private tracts, comprising approximately 416.8 acres, would be ranked as shown in Table II-7.

The revised priority acquisition parcel list for the remaining 168 private parcels in Lake Chelan NRA (revising Table 2 in the 1995 LPP) for Alternative 2 can be found in Appendix 11: *Alternatives 2 and 3 Proposed Ranking of Private Lands for the Revised Land Protection Plan*.

### *Land Use Protection Priorities*

#### Alternative 4

The priorities resulting from application of the criteria are reflected in Table II-7: *Comparison of LPP Priorities for Private Lands in Alternatives 2 - 5* and are different from those in Alternatives 2 and 3 to allow the Stehekin Valley Road to remain in place in McGregor Meadows. In Alternative 4, the criteria are weighted toward protecting existing Lake Chelan NRA development and infrastructure in place, while protecting Lake Chelan NRA resources, including key wetland, wildlife, vegetation, and cultural resources. This alternative would not allow the Stehekin River to migrate within its channel migration zone in McGregor Meadows to the same extent as in Alternatives 2/5 and 3. Under the revised LPP, the remaining 168 private tracts, comprising approximately 416.8 acres, would be ranked as shown in Table II-7: *Comparison of LPP Priorities for Private Lands in Alternatives 2 - 5*.

The revised priority acquisition parcel list for the remaining 168 private parcels in Lake Chelan NRA (revising Table 2 in the 1995 LPP) for Alternative 4 can be found in Appendix 12: *Alternative 4 Proposed Ranking of Private Lands*.

#### Alternative 5

Similar to Alternative 4, the criteria have been modified to focus more on protecting the most vulnerable areas near the Stehekin River from additional impacts. This focus would give a higher priority for exchange to those lands in deposition zones or debris cones at McGregor Meadows and at the river mouth. As in Alternatives 2 and 3, this would allow the Stehekin River to migrate and occupy its floodplain at critical areas. Under the revised LPP, the remaining 168 private tracts, comprising approximately 416.8 acres, would be ranked as shown in Table II-7: *Comparison of LPP Priorities for Private Lands in Alternatives 2 - 5*.

The revised priority acquisition parcel list for the remaining 168 private parcels in Lake Chelan NRA (revising Table 2 in the 1995 LPP) for Alternative 5 can be found in Appendix 13: *Alternative 5 Proposed Ranking of Private Lands*. The highest priority for acquisition of interest would be for properties that lie within sediment deposition zones within the Stehekin River channel migration zone and/or have other resource concerns that cumulatively elevate the need to protect the properties.

# 2. Stehekin Valley Road Modifications

## Stehekin Valley Road Alignment

### *Alternative 1*

Reroutes / Protection Strategies

There would be no major reroutes of the Stehekin Valley Road. The road would continue to be maintained in its current location through the additional implementation of bank-protection strategies. Minor realignments would occur at Wilson Creek (see "B. Actions Common to All Alternatives [1 - 5]" on page 102) and within McGregor Meadows to implement the Road Improvement Project (NPS LACH 2005a) (see below).

Major Road Failure

Actions would be the same as "B. Actions Common to All Alternatives (1 - 5)" on page 102.

### *Alternative 2 and 5*

Reroutes: McGregor Meadows and Lower Field

Under Alternatives 2 and 5, the Stehekin Valley Road would be rerouted for approximately 1.9[1] miles beginning at Milepost 5.7 (see Figure II-5: *McGregor Meadows Reroute Map*). The reroute would be a single-lane road with new pullouts appropriately spaced to provide adequate sight distance to allow two-way traffic to pass safely. In contrast to the relatively flat existing section of the Stehekin Valley Road, the maximum grade of the reroute would be as steep as six percent, and the road would be moderately rolling in nature, with fairly steep ascents and descents, as it passes through the forested area above the current Stehekin Valley Road. Overall, the new roadway would affect an area of up to 13 acres of previously undisturbed land.

To provide access to private property, a portion of the original alignment of the Stehekin Valley Road would be retained as the 0.8 mile "McGregor Meadows Access Road" from the beginning of the realignment to approximately Milepost 6.5, at the last private driveway, and a small parking area (turnaround) would be designated to provide access to the Lower Valley Trail. This turnaround would accommodate parking for approximately two vehicles by including a part of the rerouted road and an adjacent wide area.

The access road would be maintained to a lower standard than the existing gravel road. Between Milepost 6.5 and Milepost 7.5, the existing road surface would be removed and restored to trail standards to become the alignment for a portion of the Lower Valley Trail. The trail would remain accessible for maintenance of grade-control structures at Milepost 6.8. These structures were designed to minimize the potential for the river to flow down the road, inundating drain fields and other development. The abandoned section of road (after the access road) would be restored, including the former road alignment and the riparian area near Lower Field. Access to the Lower Field would be maintained from the upstream end for the existing Special Use Permit for the agricultural field.

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*1* This and other included estimates in the text that follows are based on 75 percent design. As a result, the actual quantities could change by approximately ten percent.

If major road failure occurred from a catastrophic river avulsion (major channel shift) and loss of major sections of road occurred and affected private property access, the NPS would work with private landowners to determine how to restore access across federal land, if needed, or to encourage land exchange, if appropriate. Landowners would continue to be responsible for maintaining access roads on their property.

Whether restoration of access would include rebuilding the access road, rerouting, or some combination of these would be determined as it has been, on a case-by-case basis, and would be designed to limit impacts to Lake Chelan NRA resources.

**Reroute Road Specifications:** The reroute would be 16 feet wide and would tie in to the existing alignment of the Stehekin Valley Road before McGregor Meadows and above the Lower Field. All of the new disturbance from the roadway would be outside the channel migration zone, thereby greatly reducing impacts to riparian areas and the likelihood of future flood damage to the road or temporary road closure during floods. If the material generated from proposed cuts is adequate, fill needs would be accommodated. If not, the balance of material needed would come from other project areas or would be barged in from outside the park. Combined, the McGregor Meadows and Lower Field reroutes would produce approximately 30,000 cubic yards of material from cuts, and 25,000 cubic yards would be needed for fills. The road surface would then be overlain with compacted gravel and surfaced with asphalt chipseal.

Photo 12 – Bank erosion at Weaver Point.

Clearing width for the new roadway would range from 40 to 100 feet. Vegetation disturbance would be limited to the minimum necessary for construction activities, including construction of cuts and fills, drainage features such as ditches and culverts, and use of construction equipment. Clearing limits would be delineated in advance of any construction activities. Soil-erosion and sediment-control devices would be implemented and maintained during and after construction until vegetation is established. During revegetation, the area landscape outside the constructed road would also be covered with material salvaged from the road construction, including topsoil, duff, logs and boulders.

**Pullouts:** Up to 30 pullouts would be designed as needed to provide adequate sight distance. On average, the pullouts would be approximately six feet wide and 20 feet long, and would taper on both ends, but would vary in size and spacing depending on available terrain. They would have a trapezoidal shape and would be surfaced. Drainage, including roadside ditches and culverts (24 - 36 inches in diameter), would be provided where needed (approximately every 500 feet on the existing alignment).

Like the current alignment, the proposed realignment would cross approximately seven intermittent streams. These streams have the potential to carry large amounts of water and debris during floods but also run dry for several months each year. To accommodate this capacity, approximately seven 60-inch culverts would be installed. Ditch relief culverts (generally 24 - 36 inches in diameter) are planned approximately every 300 to 350 feet.

Approximately 13.0 acres would be cleared for road construction; all of this would be within suitable and potentially occupied northern spotted owl habitat.

**Alternative 2 Private Access, including through McGregor Meadows:** With the road reroute, access would continue to be maintained along the former alignment of the Stehekin Valley Road, termed here the "McGregor Meadows Access Road" as long as needed. The McGregor Meadows Access Road would be maintained as a one-lane "driveway" of variable width (12 - 16 feet wide). Unlike in Alternative 1, however, this portion of the road would not be realigned or raised, nor would it be surfaced. As a result, it would continue to be affected periodically by flooding.

This section of the former Stehekin Valley Road would continue to provide access to approximately 12 parcels now in private ownership as long as those parcels remained private, as well as for utility system infrastructure and emergency access / egress. As noted, access would also continue to be maintained along the Company Creek Road and Stehekin Valley Road, except in some areas during flood conditions. If necessary, priority for restoring access would be given to actions needed on Stehekin Valley Road prior to actions along the McGregor Meadows Access Road.

**Alternative 5 Private Access, including through McGregor Meadows:** Based on the likelihood of a major washout in lower McGregor Meadows, a Reroute Access Connector between the McGregor Meadows / Lower Field reroute (Stehekin Valley Road) and the McGregor Meadows Access Road would be constructed. This access road would link the rerouted Stehekin Valley Road to McGregor Meadows, in the event of a catastrophic river avulsion. It would allow vehicles to access recreational opportunities and the 12 private parcels currently within McGregor Meadows. In the future, if there was no access to private property needed in McGregor Meadows, this connector would be removed and rehabilitated. If major road failure occurred from a catastrophic river avulsion (major channel shift) and loss of major sections of road occurred and affected private property access, the NPS would work with private landowners to determine how to restore access across federal land, if needed, or to encourage land exchange, if appropriate. Landowners would continue to be responsible for maintaining access roads on their property.

Whether restoration of access would include rebuilding the access road, rerouting, or some combination of these would be determined as it has been, on a case-by-case basis, and would be designed to limit impacts to Lake Chelan NRA resources.

#### Major Road Failure

In addition to the actions in Alternative 1, if loss of the roadway occurred at Milepost 3.8 (Frog Island), Milepost 5.3 (Wilson Creek), or Milepost 8.0, the NPS would reconstruct the road in place because the road is adjacent to steep slopes at the edge of the channel migration zone in these areas and it would not be feasible to relocate the road. Although the road could be moved, the impacts of doing this (requiring either the removal of an excessive amount of material or very long reroute) would be greater than retaining the road in its existing location (see "D. Alternatives and Actions Considered but Dismissed").

### *Alternative 3*

#### Reroutes

Only the McGregor Meadows reroute would be constructed. As a result, the existing alignment of the Stehekin Valley Road alongside the Lower Field would be retained (see Figure II-5).

**McGregor Meadows Reroute Actions:** In Alternative 3, a smaller portion of the Stehekin Valley Road (1.75 miles) would be rerouted around McGregor Meadows and would connect with the existing alignment at approximately Milepost 7.41. The rerouted road segment would descend to reconnect with the existing road near the downstream end of the Lower Field. Instead of rerouting the road around the Lower Field (as in Alternative 2), the existing alignment would be reinforced with a series of rock barbs, bioengineering, and riparian restoration measures to stabilize the section of roadway in its current alignment in that area.

As in Alternative 2, the road would be designed as a single-lane road, 14 - 16 feet in width, with pullouts to allow two-way traffic to pass safely. With a maximum grade of six percent, the road would have fairly steep ascents and descents, including a very steep descent across a large amount of fill to the Stehekin Valley Road at the Lower Field. Overall, the new roadway would affect about the same amount of area as the reroute in Alternative 2 (approximately 13.0 acres). Approximately 30,000 cubic yards of material would be produced from cuts and 23,000 cubic yards would be needed for fills. As in Alternative 2, the road surface would be overlain with compacted gravel and surfaced with an asphalt chip-seal. In Alternative 5, there would be 30,200 cubic yards for cuts and 27,000 cubic yards for fills.

Similar to the current alignment, the proposed realignment would have about seven stream crossings with the same design as Alternative 2. Road restoration, grade-control maintenance, and private access to McGregor Meadows would be the same as in Alternatives 2 and 5.

All of the approximately 13.0 acres cleared for road construction would be within northern spotted owl habitat (the same as in Alternatives 2 and 5); however, 1.2 acres also would remain within the channel migration zone (unlike Alternatives 2 and 5).

**Private Access, including through McGregor Meadows:** Actions would be the same as in Alternative 2. There would continue to be access to the approximately 12 parcels of private land located along the McGregor Meadows Access Road.

### *Alternative 4*

#### Specific Reroutes / Protection Strategies

Actions would be the same as in Alternative 1. There would be no reroutes of the Stehekin Valley Road. The road would continue be maintained in its current alignment, the grade would be raised, and sections in the floodplain / channel migration zone at McGregor Meadows would not be surfaced.

**Private Access:** Actions would be the same as in Alternative 1. Access would continue to be maintained where the road grade is raised through McGregor Meadows.

#### Major Road Failure

Actions would be the same as "B. Actions Common to All Alternatives (1 - 5)" on page 102.

## Stehekin Valley Road Improvement Project Implementation

### *Alternative 1*

#### General Improvements

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102.

#### Site-Specific Improvements

To increase survivability of the section of road through McGregor Meadows in future flooding, the grade would be raised in two sections, as called for by the Stehekin Valley Road Improvment Project, to complement another section that was raised in response to the 2003 and 2006 flooding. Over time, additional erosion protection strategies and bank-hardening measures would likely be needed as the river moved toward the road, including additional barbs currently proposed in Alternative 4. Minor reroutes could also be considered if necessary, but there would be no major reroute of the road. A small section of road near Wilson Creek would be realigned away from a 20-foot-tall, eroding bank. Rock and log-cribbing would be placed on the slope below the road to slow future erosion during floods (see "Wilson Creek" Section 11.d. Stehekin Valley Road Milepost 5.3 [Wilson Creek]).

#### Raising the Road

Between Milepost 6.25 and 6.53 and Milepost 6.95 and 7.14, in McGregor Meadows, the road would be raised one to three feet, and culverts would be added as appropriate. Raising the road grade would elevate part of the road above floodwater that occurs during spring and fall flooding. Elevating the road grade could prevent the Stehekin River from occupying sections of the floodplain and channel migration zone in this area, with consequent effects on floodwater depth and flow velocity on neighboring properties. Although the road grade raise is proposed to protect the Stehekin Valley Road, it could result in additional flood protection for some private property, while potentially worsening flooding elsewhere.

Raising the road above the level of flooding would require importation of approximately 5,600 cubic yards of fill. Raising the road grade would also allow ditches to be recreated to help direct water away from the road surface. Where fill is proposed to raise the road, fill slopes would be kept as steep as possible to minimize the disturbance footprint.

#### Milepost 6.0 - 6.5

Between Mileposts 6.0 and 6.5, the Stehekin Valley Road would be raised and realigned and a portion of the adjacent slope would be laid back to improve sight distance, with a dry-stacked rock wall constructed to retain the slope. Laying back the slope and removing a protruding eyebrow of material may lessen the potential for material to slough off the slope onto the road. Actions at this location would partially affect private property, and therefore require an easement.

The slope soil is very loose (unconsolidated), and revegetation of the slope may require covering the slope with fallen trees, duff, and litter. A dry-laid rock wall would be constructed at the toe of the slope to collect any material sliding off the slope and to enhance slope stability. Eyebrow removal would produce approximately 1,000 cubic yards of material and the drystack rock wall would be approximately 200 feet long and ten feet high. Nearby, the road grade may need to be raised to allow access to private property (NPS LACH 2005a:24).

### *Alternatives 2, 3 and 5*

#### General Improvements

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102.

#### Site-Specific Improvements

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102 except that at Wilson Creek different erosion protection measures would be used and the road would be raised slightly rather than lowered.

### *Alternative 4*

#### General Improvements

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102.

#### Site-Specific Improvements

Actions would be the same as described in Alternative 1 except associated with Wilson Creek. In addition, as in Alternative 1, the road would be raised above the level of flooding in McGregor Meadows. This would require importation of approximately 5,600 cubic yards of fill. Raising the road grade would also allow ditches to be recreated to help direct water away from the road surface. Where fill is proposed to raise the road, fill slopes would be kept as steep as possible to minimize the disturbance footprint.

## 3. Stehekin Valley Road / Company Creek Road—Private Access

### Alternative 1

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" page 102.

### Elements Common to Alternatives 2 - 4

Under Alternatives 2 - 4, unless catastrophic changes prevented it and it became necessary to limit impacts to Lake Chelan NRA resources, reasonable access to private property would continue to be achieved via privately maintained spur roads that branch off the Stehekin Valley and Company Creek roads. If catastrophic loss occurs, a criteria-based decision-making process (including additional environmental analysis as warranted) would be used to determine how reestablishment of the original access to the private property, or a reroute, or some combination of these would be implemented.

### Alternative 5

The Reroute Access Connector would provide access to the McGregor Meadows area if the existing alignment washes out and repairs are too expensive and/or the NPS cannot obtain needed permits to repair it (i.e. river runs down road through summer). The road would be approximately 12-feet wide and 940 - 1,200 feet long. In the future, if private property access in McGregor Meadows was no longer needed, this connector would be rehabilitated.

## 4. Recreational Facilities

### Alternative 1

#### *General*

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102.

Compatible recreational facilities located in the floodplain would remain, subject to their persistence and the continued ability to use them safely. These include campgrounds, picnic areas, Bullion Raft Launch, and area trails. In addition, as described under "1. GMP Implementation," construction of the Lower Valley Trail, including connecting it to the Stehekin River Trail, would occur.

### *Campgrounds*

Actions would be taken as needed in response to flooding. Seasonal closures would continue to occur during the spring and fall. No new campgrounds would be established.

**Harlequin Campground:** The campground would be maintained in its existing location. Harlequin Campground currently contains one 24-person group site and six individual sites, each with a limit of four people. Harlequin Campground is located across Harlequin Bridge off the Company Creek Road. Seasonal flooding in fall and spring has continued to affect the campground, particularly the group site, which like others is close to the Stehekin River, and which is slightly lower in elevation than other sites.

**Purple Point Horse Camp:** There would be no changes to this camp. It would continue to be used as an overflow group site and horse camp.

**Bullion Campground:** Bullion Campground would be relocated across the road to avoid an area of hazard trees that are deteriorating because of root rot. The two campsites would be moved across the road, near the Stehekin River, upstream from the raft launch. The current site, however, would be retained for day-use picnicking to accommodate longstanding Stehekin Community events that occur there.

The proposed relocated campground would be concealed from most views along the Stehekin Valley Road and would have adjacent river access in a relatively open area with scattered Douglas-fir. The area has an understory of kinnickinnick, Oregon grape, serviceberry, ceanothus, spirea, yarrow, and other forbs and grasses, as well as moss-covered boulders. The proposed area is approximately 100 feet by 20 feet (2,000 square feet, or 0.05 acre).

### *Trails*

**Lower Valley Trail:** The Lower Valley Trail would be designed and constructed as time and funding allowed. Construction would eventually include a trail bridge across the Stehekin River to connect it to the Stehekin River Trail. A footbridge across the Stehekin River at or near the former concrete road bridge abutments above Boulder Creek would enhance access to the River Trail and Weaver Point Campground from the lower Stehekin Valley, and would make additional loop trails available. In Alternative 1, the Lower Valley Trail would use approximately 6.1 miles of existing trail and 6.3 miles of new trail.

### *River Access Point*

The existing river access point downstream from Bullion Campground (across from Bullion Loop Trail) would be retained. No new river access points would be constructed.

### *Shooting Range*

The shooting range would be maintained in its existing location.

## Elements Common to Alternatives 2 - 5

### *Campgrounds*

**Purple Point Horse Camp:** Under Alternatives 2 - 5, the individual sites at this campground would be modified to accommodate group use during seasonal flooding anticipated to occur in spring and fall at Harlequin Campground.

The proposed group site additions to the Purple Point Horse Camp are located close to the Golden West Visitor Center near an existing horse corral, close to the well water tank near Purple Creek. The new sites would be managed primarily for the ability to replace the group site at Harlequin Campground during seasonal flooding; however, they would also be available at other times of year for individual use. Approximately four sites would be established that could be used in combination as one or two group sites (12 people) when needed in the spring and fall. The sites would have two to three tent pads, picnic tables, a food-storage container, and a fire grate. The existing toilets would be improved or additional vault toilets would be added.

The area that would be used is approximately 150 feet x 50 feet (7,500 square feet, or 0.17 acre) and is within a Douglas-fir-ponderosa pine forest with scattered bigleaf maple among cobbles and occasional boulders. The understory primarily consists of grasses, Oregon grape, and spirea.

**Harlequin Campground:** As in Alternative 1, Harlequin Campground would be maintained in its existing location and would continue to be used except during periods of flooding. In Alternatives 2 - 5, Harlequin Campground group sites would be temporarily closed during anticipated flooding. Campsites constructed at Purple Point Horse Camp to replace the seasonally flooded group sites at Harlequin would compensate for the temporary closure of the Harlequin Campground group site prior to the advent of likely flooding.

**Bullion Campground:** As in Alternative 1, Bullion Campground would be relocated across the road to avoid an area of hazard trees that are deteriorating because of root rot. The two campsites would be moved across the road, near the Stehekin River, upstream from the raft launch. The current site would be retained for day-use picnicking to accommodate longstanding Stehekin Community events that occur there.

**Rainbow Falls Campground (New):** In Alternatives 2 - 5, three to four individual walk-in campsites would be constructed near Rainbow Falls. The campsites would be separated from each other along a former roadway just north of the existing Rainbow Falls toilets. The campsites would include access to improved (existing) Rainbow Falls toilets, as well as picnic tables, tent pads, food-storage containers, and fire pits / grates. The proposed campground at Rainbow Falls would take advantage of existing parking. Water would be available from nearby Rainbow Creek. If unacceptable impacts are later identified, a water collection site could also be designated. The area is located in the lower Stehekin Valley, within easy walking distance of Stehekin Landing (approximately three miles) and Buckner Homestead. Proposed campsites would be located away from a rock fall area, and would be concealed from the Stehekin Valley Road.

The proposed campground area would be about 200 feet long by 20 feet wide and would occupy 4,000 square feet (0.10 acre) within a Douglas-fir-ponderosa pine forest with a low-growing understory of kinnickinnick and other forbs. Not all of this area, however, would be impacted, because the campsites would be separated from each other. Large gneiss boulders scattered throughout the area would partially conceal the sites.

### *Trails*

**Lower Valley Trail:** In Alternatives 2 - 5, the Lower Valley Trail would be constructed in a single complete project to connect Stehekin Landing with High Bridge using sections of existing trail and construction of new trail as described in "B. Actions Common to Alternatives (1 - 5)." As noted, a footbridge crossing of the Stehekin River would be added to connect the proposed Lower Valley Trail with the Stehekin River Trail.

## Alternatives 2 and 5

### *Campgrounds*

Actions for campgrounds would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102 and "Elements Common to Alternatives 2 - 5: Recreational Facilities" in this section.

### *Trails*

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102. The Lower Valley Trail would use 4.6 miles of new trail and 7.9 miles of existing trail.

### *Stehekin River Access Point / Boat Access*

In Alternatives 2 and 5, a new river access point and small parking area would be constructed above the mouth of the Stehekin River. This river access point would enable more direct egress from the river following a trip and would reduce conflict with adjacent private landowners by providing public egress not currently available. It would also provide for nonmotorized boat access to the lower Stehekin River and the head of Lake Chelan. To provide access to public land, the new river access point would be located off a small (300-foot-long, 14-foot-wide) spur road from the Stehekin Valley Road and would include a small parking area (see Stehekin River Mouth description below). The river access would be approximately 20 feet wide and 110 feet long, similar to the existing raft launch downstream from Bullion Campground. Constructed river access points consist of a constructed slope (usually sand and gravel with no surface treatment) wide enough for the raft and passengers to stage before entering the river. They are usually in pools to allow for safe entry into and exit from the water.

### *Shooting Range*

Because Alternatives 2 and 5 would reroute the Stehekin Valley Road along the Lower Field, the direction of existing targets would be toward the road, creating a safety hazard. As a result, the shooting range would be removed and the existing shooting range would be restored or used for the road reroute. No replacement shooting range would be constructed.

## Alternative 3

### *Campgrounds*

Actions for campgrounds would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102 and "Elements Common to Alternatives (2 - 5): Recreational

Facilities" under "4. Recreational Facilities." In addition, another campground would be constructed on NPS land downhill from the Company Creek Power Plant.

**Company Creek Campground (new):** The proposed walk-in campground would be in a previously disturbed area downhill from the Company Creek power plant, affecting approximately 0.02 acre within an area that contains scattered Douglas-fir, ponderosa pine, and bigleaf maple and an understory of bracken fern, wild raspberry, Oregon grape, wild rose, and needlegrass. Access would be on foot via the former roadbed down to the area, which would be cleared of downed logs. There would be one large group site that could also be used for two to six individual sites if warranted. Picnic tables, fire grates, tent pads, and food storage would be provided. A vault toilet would also be constructed.

Although there is currently no shuttle access to this site, it may be possible to provide access in the future, which could facilitate use. The site would provide opportunities for visitors using the Company Creek/Devore Trail and the Stehekin River Trail in a setting away from the noise along the main valley road. Camping during low water conditions could be affected by noise if the powerhouse generators were in use.

### *Trails*

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102 and Alternative 2/5. The Lower Valley Trail would use approximately 4.6 miles of new trail and 7.9 miles of existing trail.

### *River Access Point*

Because of safety concerns associated with locating a large logjam adjacent to a takeout, no river access point would be constructed in Alternative 3.

### *Shooting Range*

Because the Lower Field Reroute would not occur, as in Alternative 1, the shooting range could be maintained in its current location. The McGregor Meadows reroute would descend to the current road just before the shooting range.

## Alternative 4

### *Campgrounds*

Actions would be the same as in Alternative 3.

### *Trails*

Actions would be the same as described in "B. Actions Common to All Alternatives (1 - 5)" on page 102 and Alternative 1. The Lower Valley Trail would be able to use additional sections of the Old Wagon Road because the McGregor Meadows reroute would not occur.

### *River Access Point*

Actions would be the same as in Alternatives 2 and 5.

### *Shooting Range*

Actions would be the same as in Alternative 1. The shooting range would be maintained in its existing location because the Stehekin Valley Road would not be rerouted.

# 5. Management of Large Woody Debris

## Alternative 1

### *Park Actions*

The NPS would continue to implement GMP provisions related to the management of large woody debris. In addition, the NPS would continue to collect free-floating large woody debris from the head of Lake Chelan after flood events to prevent boating accidents and to use in erosion protection projects. Consistent with the GMP, limited actions would continue to be taken to trim or turn individual large pieces for the purpose of improving rafting safety. Removal of logs or logjams threatening public roads or bridges could also occur.

According to the GMP:

> *The National Park Service would manipulate woody debris in the Stehekin River or its tributaries only to protect public roads and bridges according to the criteria above. Woody debris could also be trimmed or turned in the lower 9 miles of the Stehekin River to allow safer recreational use of the river for rafting, kayaking, and canoeing if it did not alter the function or stability of woody debris accumulations and was permitted by the appropriate regulatory agency. Woody debris would not be removed from the river system in any case. The Park Service would not remove or manipulate woody debris on public land or water to protect private property, and it would take no action to prevent private landowners from removing or manipulating woody debris on their land to protect their property, unless these actions would significantly harm recreation area resources or were in violation of local, state or federal ordinances, regulations or laws. Such actions would not be encouraged (NPS LACH 1995a: 21 - 22).*

**Lake Chelan Woody Debris Salvage:** As noted in Appendix B of the Draft LWD Plan of the Chelan PUD relicensing EA (Chelan PUD 2002), the purpose of collecting floating large woody debris is to provide raw material for erosion control projects on the lake and to eliminate hazards to boats and float planes on Lake Chelan. These projects include use of woody debris for construction of erosion protection, as well as to provide mitigation for perceived impacts of construction activities. Collection is not meant to be comprehensive, or to wholly ensure safe boating conditions on the lake. Removal has been conducted since large floods in 1995 and 2003.

Most woody debris would continue to be collected by the NPS at the head of Lake Chelan in the days following flood events. Some of the collected material would be stored within a log boom to be established west of Weaver Point, while other material could be transported directly to an erosion protection site or stored temporarily on the barge deck. Woody debris would be collected by NPS staff using a barge and hydraulic crane purchased by Chelan PUD. The Weaver Point site was agreed to by the NPS and permitting agencies. It is also likely that some of this material will be used at USFS sites farther downlake, and potentially by private parties.

Existing criteria for woody debris suitable for collection and storage include:

- Large pieces of wood at least ten feet long;
- Large pieces of wood at least 1.0 feet in diameter;
- Large pieces of wood with root wads attached; and
- Large pieces of wood with branches.

### *Private Use*

The NPS would continue to implement GMP guidance and to provide technical assistance to landowners. Per the GMP, there would be no provisions for private landowners to use large woody debris from the head of Lake Chelan or from the Stehekin River in Alternative 1. Private landowners, however, could use trees from private land for erosion control projects with a permit from appropriate agencies. To use logs along the river, including those in logjams or side channels, private landowners would also continue to need permits from applicable county, state, and federal agencies.

## Elements Common to Alternatives 2 - 5

### *Park and Private Actions*

Alternatives 2 - 5 would allow for minimal manipulation of woody debris to protect public facilities, including roads, water quality, public safety, and regular access to private property. In Alternatives 2 - 5 the NPS could identify properties for purchase or exchange to minimize manipulation of large woody debris. As in Alternative 1, actions could also be taken to manipulate large woody debris that threatens public roads and bridges and to trim or turn pieces to enable recreational activities, and to continue to collect wood from the head of Lake Chelan.

Unlike Alternative 1, in Alternatives 2 - 5 in select areas, and on a case-by-case basis, pending analysis of impacts by park resource staff, logs could be removed from the tops of logjams for use in erosion management and riparian restoration projects. In Alternatives 2, 3 and 5, logs could be taken from within the Lake Chelan backwater zone. (The Lake Chelan backwater zone is defined as 0.25 mile from the head of the lake at full pool, where manipulation of the lake has been shown to influence flooding and deposition of gravel and wood.) In Alternative 4, the area of collection would be expanded to Bullion Camp. In all cases, where logs are used, they would be taken from above the ordinary high water mark and would not be removed if doing so would destabilize the logjam. Use of large woody debris from the tops of logjams is being proposed in Alternatives 2 - 5 to minimize importation of rock and fill into Stehekin and because the use of wood is a fish-friendly measure in barb construction and/or could be used to construct engineered logjams instead of barbs.

In Alternatives 2, 3 and 5, manipulation of logjams could occur in the mouth of the Stehekin River from Lake Chelan to Boulder Creek in the Lake Chelan backwater zone, where manipulation of the lake level has been shown to influence flooding and deposition of gravel and wood. This backwater zone has seen major growth in the volume of woody debris since 2000 (see Figure *I-6: Stehekin River Large Wood Monitoring 1984 - 2007*). A logjam in this zone could also be manipulated under emergency conditions if it flooded the Stehekin Valley Road or caused flooding of densely developed areas and threatened water quality. Manipulation would be the minimum needed to relieve the problem and all wood would remain within the channel migration zone.

In Alternatives 2 - 5, landowners would also be encouraged to use large woody debris in agency permitted erosion protection and flood protection measures. To facilitate this, large woody debris from the tops of logjams or from floating Lake Chelan salvage could be made available to landowners after being collected by the NPS. Encouraging landowners to use woody debris and use of wood from logjams would constitute a change to the GMP.

### Alternative 4

#### *Park and Private Use of Large Woody Debris*

Actions would be the same as in “Elements Common to Alternatives (2 - 5)” in this section; however, manipulation of large logjams that threaten roads or water quality and use of wood from the tops of logjams for erosion protection projects could occur anywhere along the lower Stehekin River (below the Bullion Raft Launch), instead of just up to Boulder Creek in the Lake Chelan backwater zone. As in “Elements Common to All Action Alternatives (2 - 5),” landowners could use large woody debris in agency-permitted erosion protection and flood protection measures, and a limited amount of wood from floating Lake Chelan salvage or the tops of logjams would be made available to landowners. As in “Elements Common to All Action Alternatives (2 - 5),” encouraging landowners to use woody debris and using wood from logjams would change existing GMP direction.

## 6. Flood Protection Measures

### Alternative 1

Actions would be the same as in “B. Actions Common to All Alternatives (1 - 5)” on page 102.

### Elements Common to Alternatives 2 - 5

Actions would be similar to Alternative 1, except for the following:

- Land exchanges would be emphasized to avoid continuing to take actions that affect the ability of the Stehekin River to use its floodplain / channel migration zone
- The revised LPP would allow land acquisition and encourage exchange of properties in the channel migration zone for properties outside of it
- For NPS facilities that cannot be relocated out of the channel migration zone, grade-control and erosion protection measures, including bioengineering, would be used to protect sites
- NPS recreational and administrative infrastructure would be removed from the channel migration zone to avoid impacts from flooding.

The combined strategies of increasing floodplain utilization and removing development would increase the sustainability of development in the valley more than altering the river would.

Allowing water from large floods to spread out and occupy the floodplain would decrease the erosive potential and minimize the possibility for flood damage to be focused in any one area. Land exchanges would also improve water quality by removing structures from the floodplain and would preclude actions on private lands that would impede channel migration, such as the construction of additional levees.

In Alternatives 2 - 5, actions at Boulder Creek (extension of a natural logjam over a grade-control structure) would also provide some protection from catastrophic river changes during floods by maintaining sheet flow in this low-lying floodplain.

### Alternative 4

Management would be the same as in "B. Actions Common to All Alternatives (1 - 5)" on page 102 and "Elements Common to Alternatives 2 - 5" in this section. As in Alternative 1, raising the road grade in part of McGregor Meadows could increase flood protection for some private properties and worsen it for others.

## 7. Interpretation and Education

### Alternative 1

The NPS would continue to conduct existing interpretive and educational programs and activities related to the Stehekin River.

### Elements Common to Alternatives 2 - 5

In addition to existing interpretive programming in Alternative 1, Alternatives 2 - 5 would enhance Stehekin River interpretive and educational programs for the general public, local residents, and media, with an emphasis on the value of logjams, floodplain utilization, and other key river features.

The enhancement of interpretive and educational programming for the general public, local residents, and the media would include an emphasis on the value of large woody debris in the river environment, the role of flooding in river ecosystems, and the value of minimizing human impacts to river systems, as well as highlighting river processes and the sensitive and flood-prone nature of the Stehekin River. These programs would continue to include safety messages regarding park experiences and, where appropriate, related to river hazards and other visitor safety issues.

## 8. Research and Monitoring

### Alternative 1

The NPS would continue existing research and monitoring programs, focused on large woody debris, main and side channel habitat, hydrology, fish surveys, cultural research and analysis, nonnative/invasive plants, climate change effects, and special status species research. This ongoing monitoring provides a framework for understanding the Stehekin River including how often large floods occur (flow gauge monitoring). Ongoing monitoring inventories are more fully described in Chapter III: *Affected Environment*).

## Elements Common to Alternatives 2 - 5

In addition to the actions in Alternative 1, the NPS would expand research and monitoring programs in Alternatives 2 - 5 to determine the effectiveness / consequences of erosion protection and flood protection measures, document large woody debris manipulation, etc., and would add more flow gauges on the river pending funding (at Agnes Creek and between High Bridge and Bridge Creek). The NPS would also continue to conduct more comprehensive species analysis, including repeating existing wildlife inventories.

Additional studies would include:

- Relative Hydrologic Influence of Agnes Creek, Upper Stehekin River, and Bridge Creek: Draining the drier east slope of the North Cascades, Bridge Creek is dominated mainly by spring snowmelt floods. In contrast, the upper Stehekin River and Agnes Creek are located much farther west on the Pacific Crest and have both fall-winter rain-on-snow and spring snowmelt floods. There is a need for at least one and possibly two gauges on the upper river to understand the contribution of each major Stehekin tributary to flooding in the lower valley and to provide enhanced flood forecasting and warnings.
- Up-to-date Floodplain Maps: With passage of the record floods in 1995, 2003, and 2006, the river has undergone several changes. Channel filling and river realignment have rendered the Federal Emergency Management Administration (FEMA 1981) and NPS (NOCA 1993b) floodplain maps obsolete in many parts of the valley. As a basis for planning and future county floodplain management, the NPS and Chelan County are joining with Chelan PUD to create a new floodplain insurance rate map. This effort would include surveying of 50 or more river cross sections, development of a one-dimensional hydraulic model, and creation of a computer-based map. The model would also produce supporting data such as flood depth and velocity for the lower valley. It would also be subject to FEMA approval.
- Sediment Movement: Measuring sediment discharge is difficult. Only approximate estimates for total sediment load exist for the Stehekin River. Areas of valley width and slope change, channel instability, and large wood storage zones are generally areas of rapid sediment deposition and storage in the floodplain. This study is proposed to refine understanding of sediment transport and storage in these zones, using two approaches. First, it would compare the 2007 channel topographic survey with historical FEMA, USGS, Chelan PUD, and NPS surveys to estimate the volume of sediment deposition or erosion in various reaches. Chelan PUD surveys of the river mouth in 2001 (Chelan PUD 2001a) will be particularly useful in this comparison because they give an estimate of change induced by the big floods of 2003 and 2006. Second, it would identify major sources of gravel within the watershed, including landslides and cut banks.

# 9. Weaver Point Erosion Protection Measures

## Elements Common to Alternatives 1, 2 and 5

As described in "B. Actions Common to All Alternatives (1 - 5)," the NPS would relocate shoreline campsites and the docks to minimize the need to take erosion protection actions along the Stehekin River, where erosion has recently accelerated. Weaver Point improvements identified in the FERC EA would be common to all alternatives.

No additional NPS actions would be taken on the east side of Weaver Point upstream of the cabled logs. River-caused erosion would likely proceed naturally, possibly threatening the upper end of the cabled logs.

## Elements Common to Alternatives 3 and 4

Pending completion of the FERC cultural resource site management plan by Chelan PUD, the proposed FERC 200-foot-long logjam on the south-facing side of the point would be extended approximately another 150 feet upstream to slow riverbank and lake wave erosion. The engineered logjam would be constructed using an excavator and thumb (see sidebar "Bank Barb Construction" and Figures II-10, II-11, and II-12), and would include placement of about 150 logs. The design would include bank excavation and require the use of 10 - 20 cubic yards of large rock and cables for anchors. The bank above the logjam would be revegetated with native plants. Once erosion protection measures were complete, the docks would be relocated to the west. In addition, two rock barbs and bioengineering would be used to stabilize the bank and to protect the nearest campsite from future erosion.

### Weaver Point

**Background:** Weaver Point improvements identified in the FERC relicensing EA for Lake Chelan include erosion control, recreation, and cultural resource projects (Chelan PUD 2002). The erosion control plan includes construction of a 200-foot-long logjam to protect the bank and 260 feet of rock walls to protect dock bulkheads on the south shore of Weaver Point. Although there are gentle slopes, wave and river erosion have produced an eroding bluff at the east end of the site and a five-foot-tall bluff at the west end. At the east end of the site, vegetation was historically removed for agricultural use.

Parts of the east end of the site are protected by a series of cabled logs that have worked well to slow erosion. This would be enhanced by construction of the FERC logjam. Walls made of imported rock would also be constructed near the dock bulkheads.

### Bank Barb Construction

Bank barbs would be constructed using an excavator with a thumb attachment, working "in the dry" from the bank when the river and/or lake are at low water in early spring or fall. Each bank barb includes approximately 100 cubic yards of rock and/or logs, a portion of which would be placed landward of the shoreline to allow the barb to "'key" into the bank and to prevent the river from eroding around the structure. The instream part of the barb would have a low profile that tapers into the channel, which would be completely submerged by flows over 5,000 cfs. The bank barbs would be approximately 20 feet long, and would protrude no more than 1/4 of the way across the low-flow channel to avoid creating too much turbulence (see Figure II-11: *Rock Barb Construction Detail*).

**Figure II-10: Weaver Point Erosion Protection Measures under Alternatives 3 - 4**

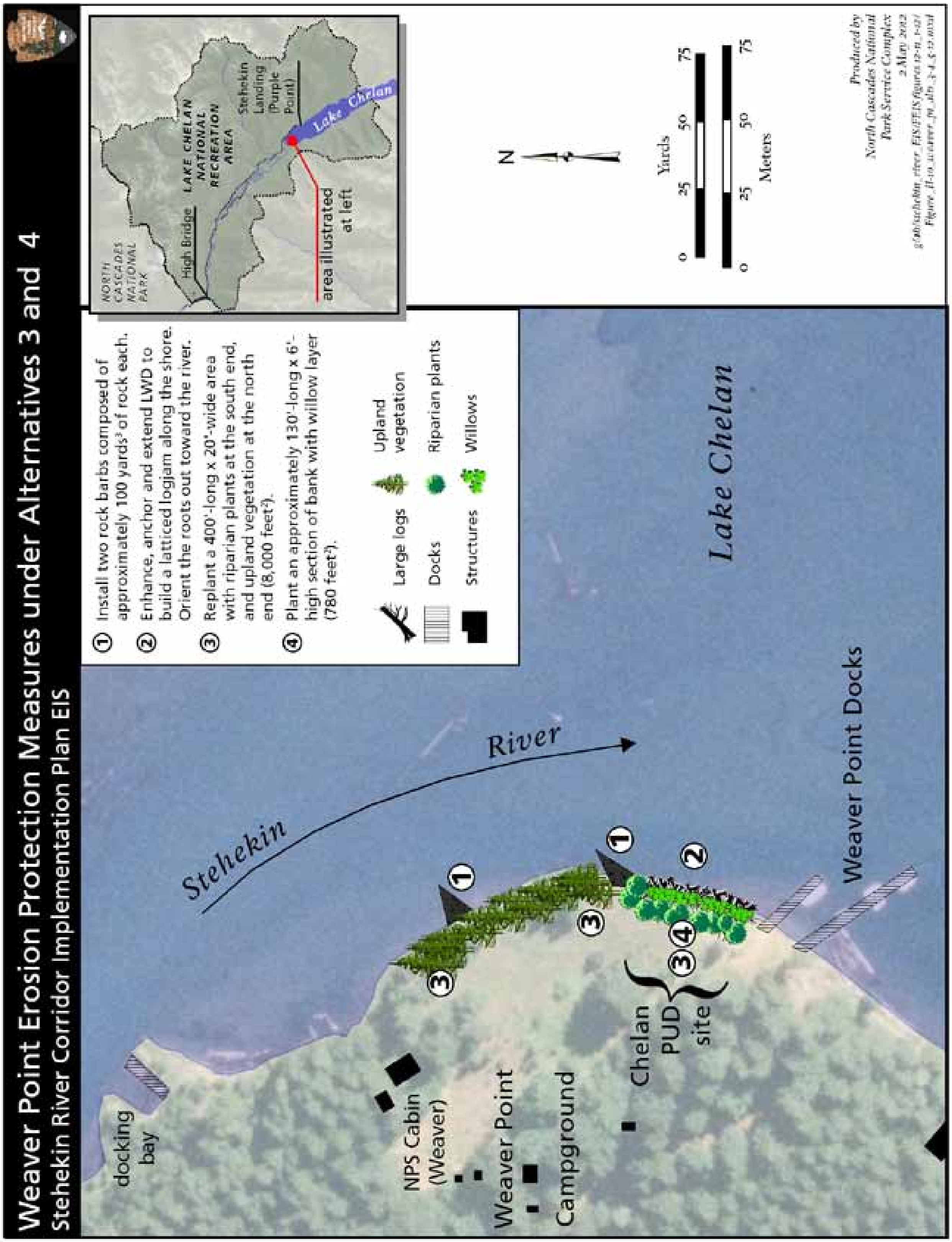


**Figure II-11: Rock Barb Construction Detail**

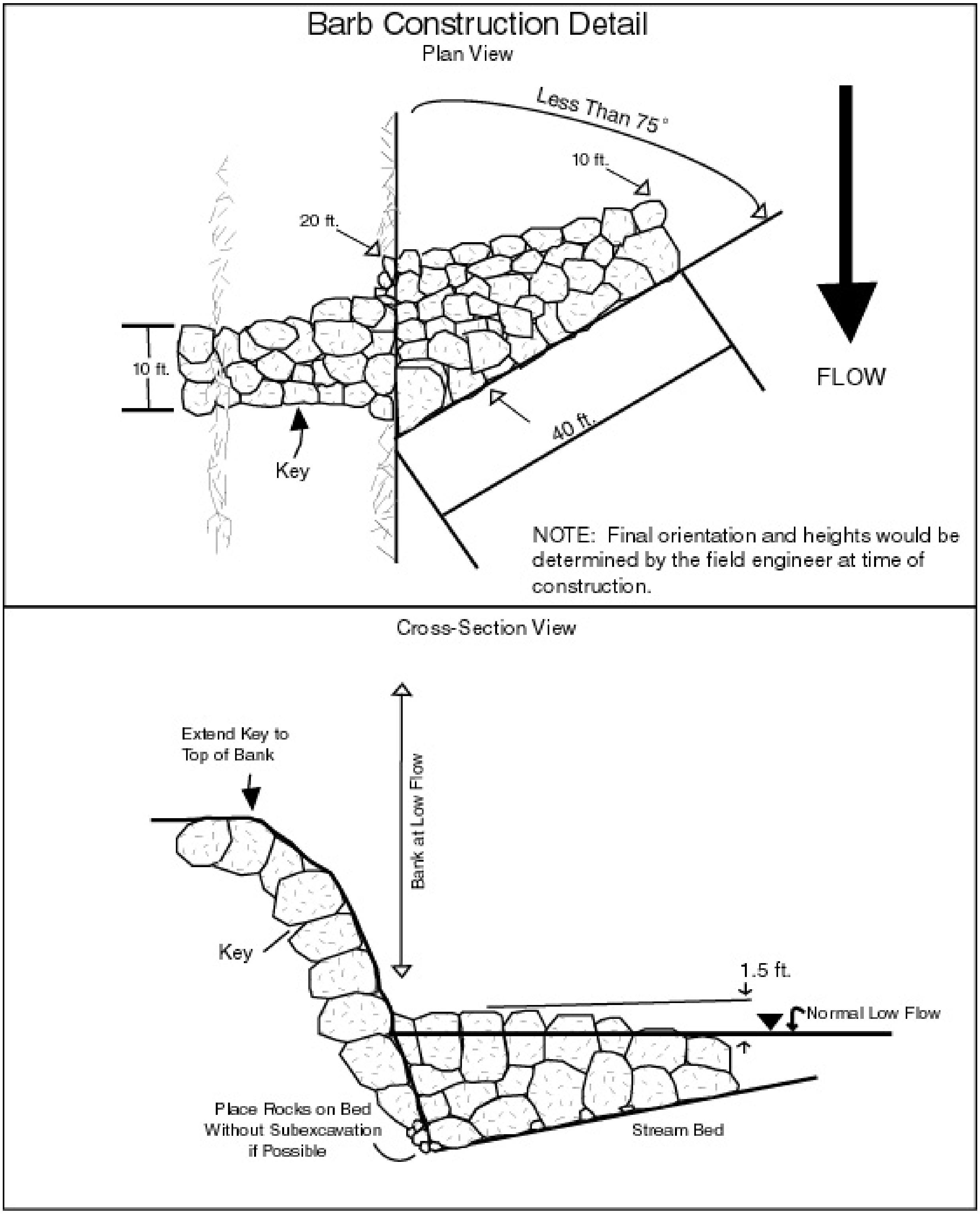
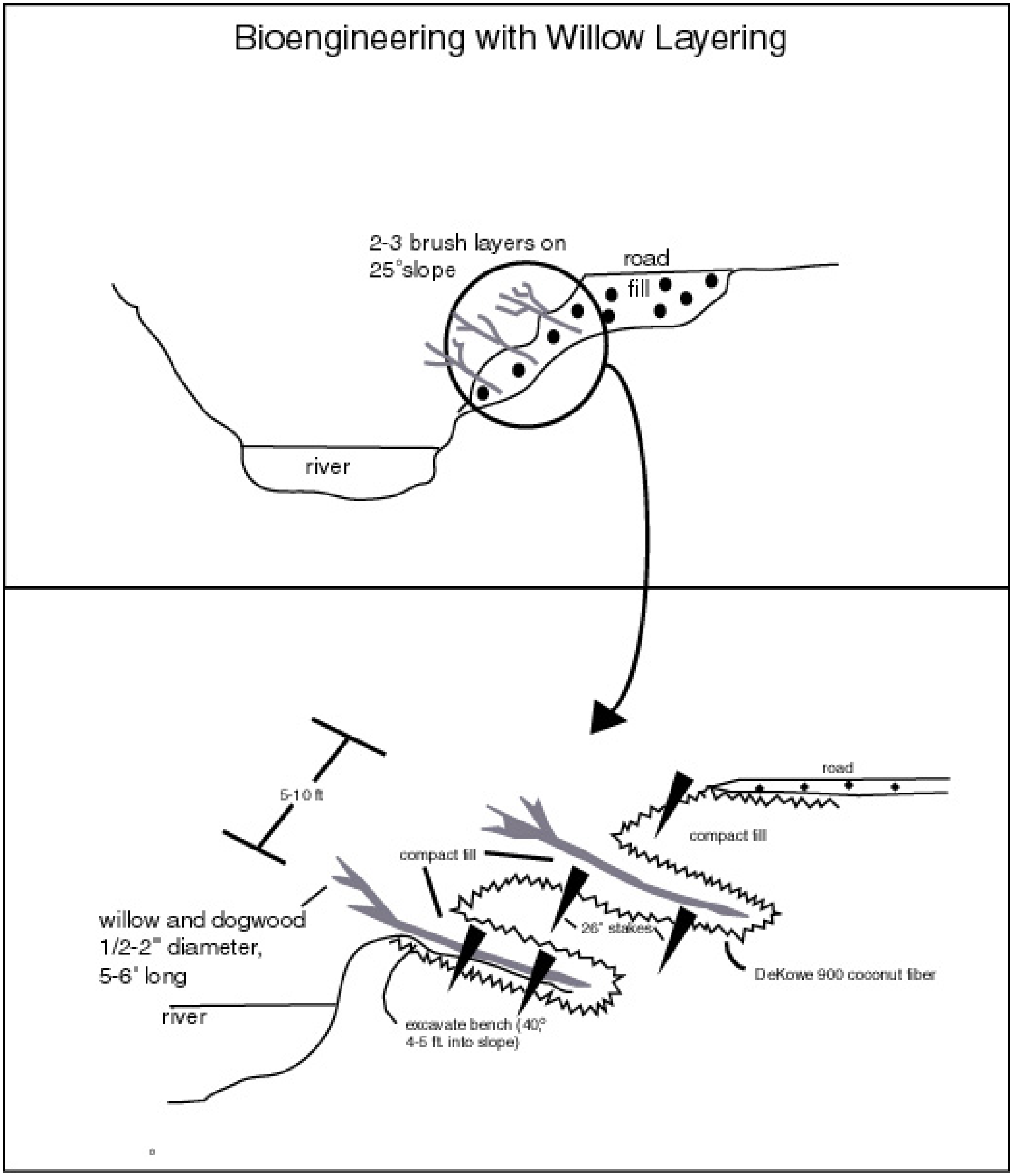


**Figure II-12: Bioengineering Construction Detail**



The rock barbs would be located along the bank of the mouth of the Stehekin River. Combined with placement of an engineered logjam (150 feet × six feet × six feet), an area approximately 130 feet by six feet (780 square feet, or 0.02 acre) would be restored with willows. In addition, riparian restoration would affect an area of approximately 400 feet by 20 feet (8,000 square feet, or 0.18 acre). Construction of the rock barbs could require that the docks be moved to the west, and pilings replaced with submerged anchors.

## 10. Stehekin River Mouth Erosion Protection Measures

### Alternative 1

No action would be taken in Alternative 1 to restore the rip-rap bank or to prevent the river from cutting a new path on NPS land above the mouth of the Stehekin River. Along the River Resort Road, the Stehekin River is migrating rapidly into its northeast or left bank (facing downstream). At this location, the Stehekin River has the potential to cut a new channel across the access road toward the Stehekin Valley Road, where it could reconnect with old channels and affect a densely developed area, causing unacceptable water quality impacts in the low-lying Stehekin River and Lake Chelan. If this new channel formed, however, the river would not be expected to immediately affect the Stehekin Valley Road or other NPS infrastructure but would be anticipated to affect it over time and during floods.

### Alternatives 2, 4 and 5

In Alternatives 2, 4 and 5, approximately 500 feet along the bank of the Stehekin River would be treated with several erosion protection measures, including a small logjam (100 feet × six feet × six feet) with about 50 logs, three rock barbs, and bioengineering. These actions would enhance habitat by replacing approximately 100 feet of rip-rap installed after the 1982 flood on NPS land with bioengineering and large woody debris; would prevent potential channel avulsion; would allow for the construction of a river access point (see "4. Recreational Facilities"); and would restore natural vegetation to this eroding bank (Figure II-13: *Stehekin River Mouth Erosion Protection Measures under Alternatives 2, 4, and 5*). To avoid impacts to private land from a new public access point, a 300-foot-long access road would be built off of the Stehekin Valley Road. The new portion of the route to the river access point would follow an old disturbed road bed.

### Alternative 3

In Alternative 3, a large engineered logjam (approximately 500 feet × 15 feet × 15 feet) consisting of several hundred logs would be designed to slow bank erosion. The design would include features to minimize hazards to boaters. Final design would be approved in consultation with a consortium of river rafting guides in a process developed by King County. The logjam would also be used to replace the rip-rap on federal land. The design would include use of about 50 cubic yards of large rock for anchors and revegetation of areas above and between logs (Figure II-14: *Stehekin River Mouth Erosion Protection Measures under Alternative 3*).

**Figure II-13: Stehekin River Mouth Erosion Protection Measures under Alternatives 2, 4 and 5**

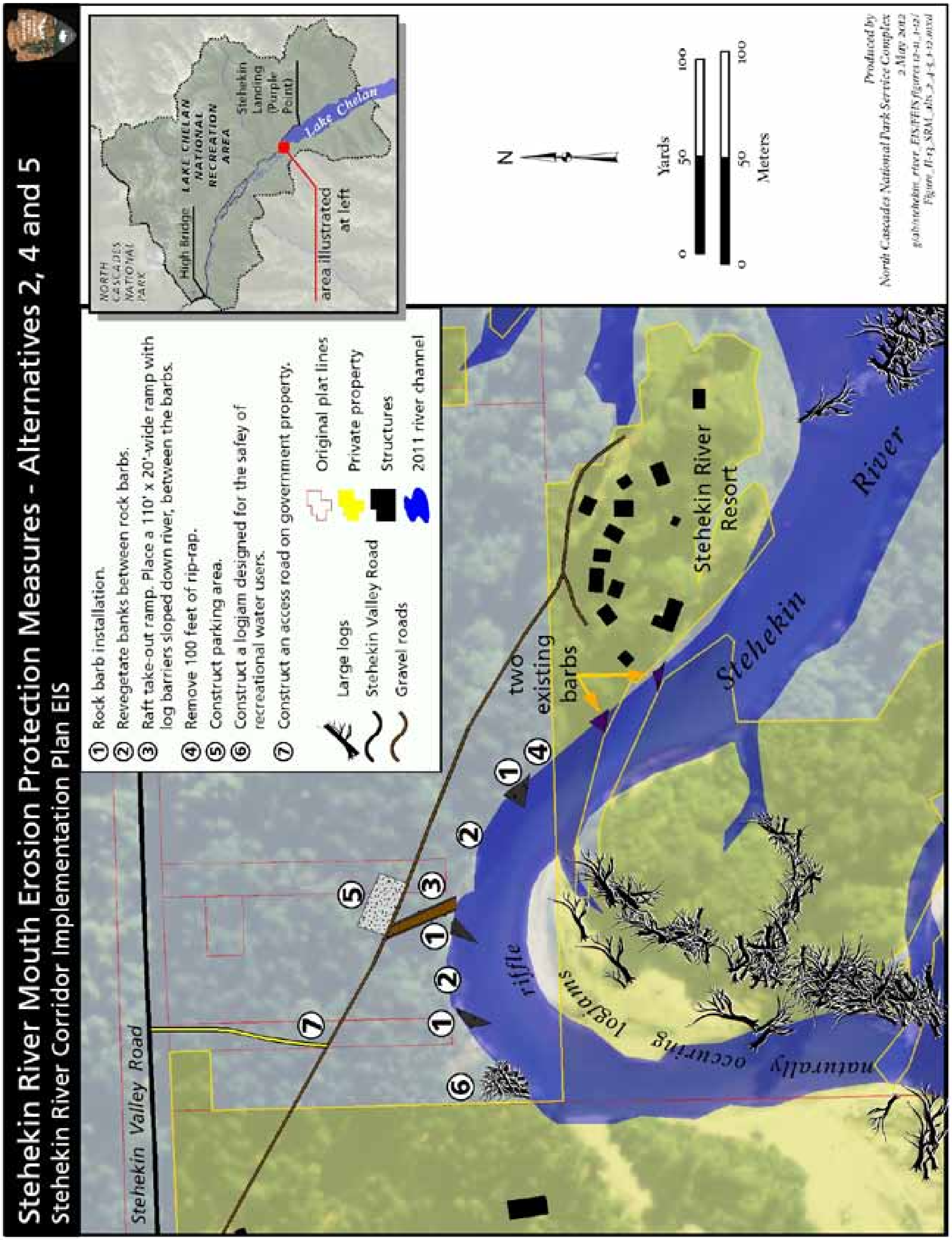
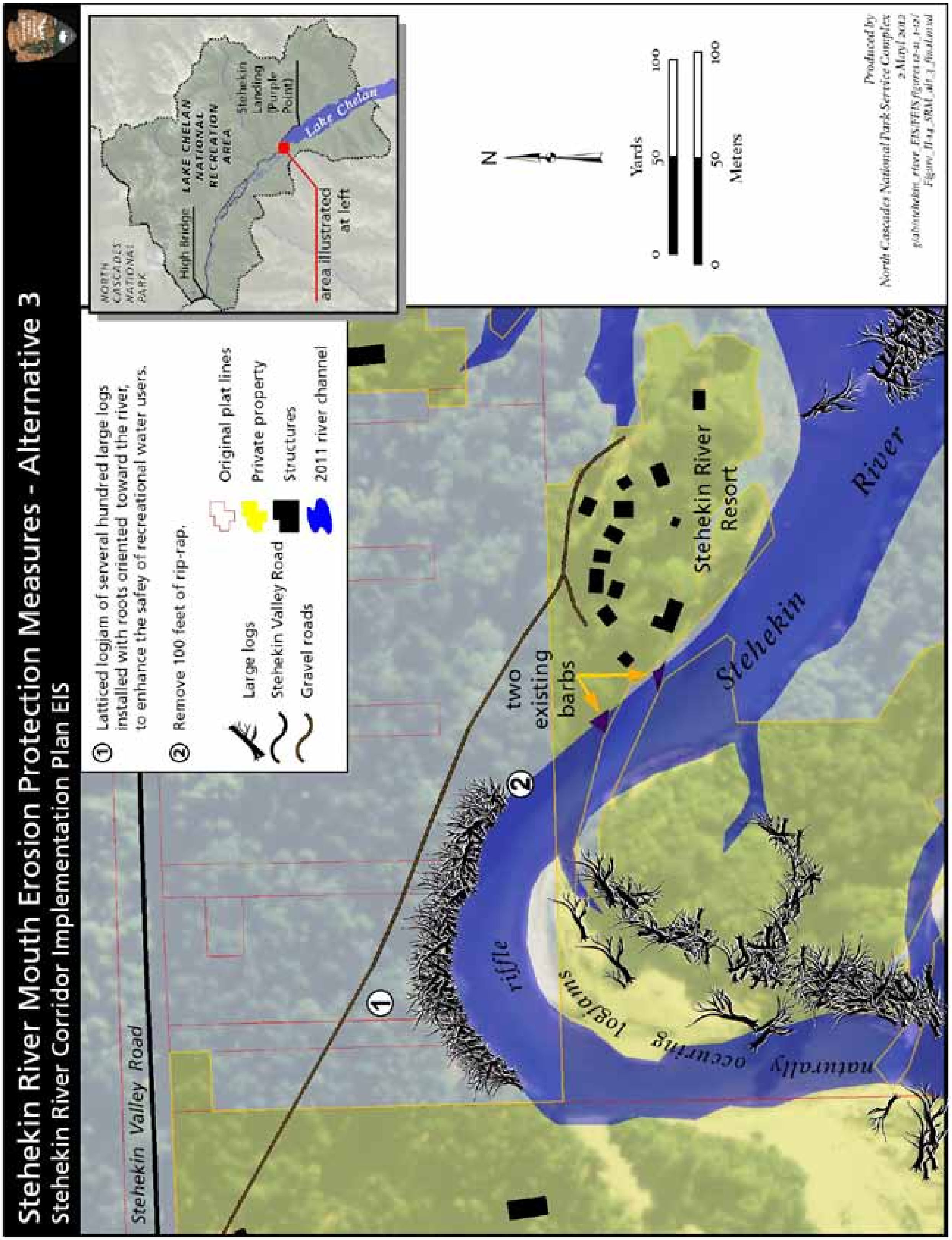


**Figure II-14: Stehekin River Mouth Erosion Protection Measures under Alternative 3**



# 11. Stehekin Valley Road Erosion Protection Measures

## Stehekin Valley Road Milepost 2.0 (Boulder Creek)

### *Alternative 1*

The Stehekin Valley Road near the bakery would be repaired as needed following flood damage. During recent flooding in 2003 and 2006, the Stehekin River flowed overland in the vicinity of the developed area near the bakery, including near NPS and private housing (Figure II-15: *Stehekin River Mouth / Milepost 2.0, Boulder Creek*). Damage to the internal developed roads and Stehekin Valley Road has been minor, but these overland flows have the potential to consolidate into ever-deepening and faster channels. Unlike sheet flow, these channels can cause major damage to roads and development. In this alternative, no major actions would be taken to prevent the channelization of overland flow; however, if damage to the Stehekin Valley Road occurred, it would be repaired as needed.

Although NPS action would only be taken if the road needed repair following flooding, area residents would be encouraged to protect their property from flooding by using measures advocated by the Army Corps of Engineers "Advanced Flood Protection Measures" memo (see "B. Actions Common to All Alternatives [1 - 5]" on page 102 and Appendix 7).

### *Elements Common to Alternatives 2 - 5: Stehekin Valley Road Milepost 2.0 (Boulder Creek)*

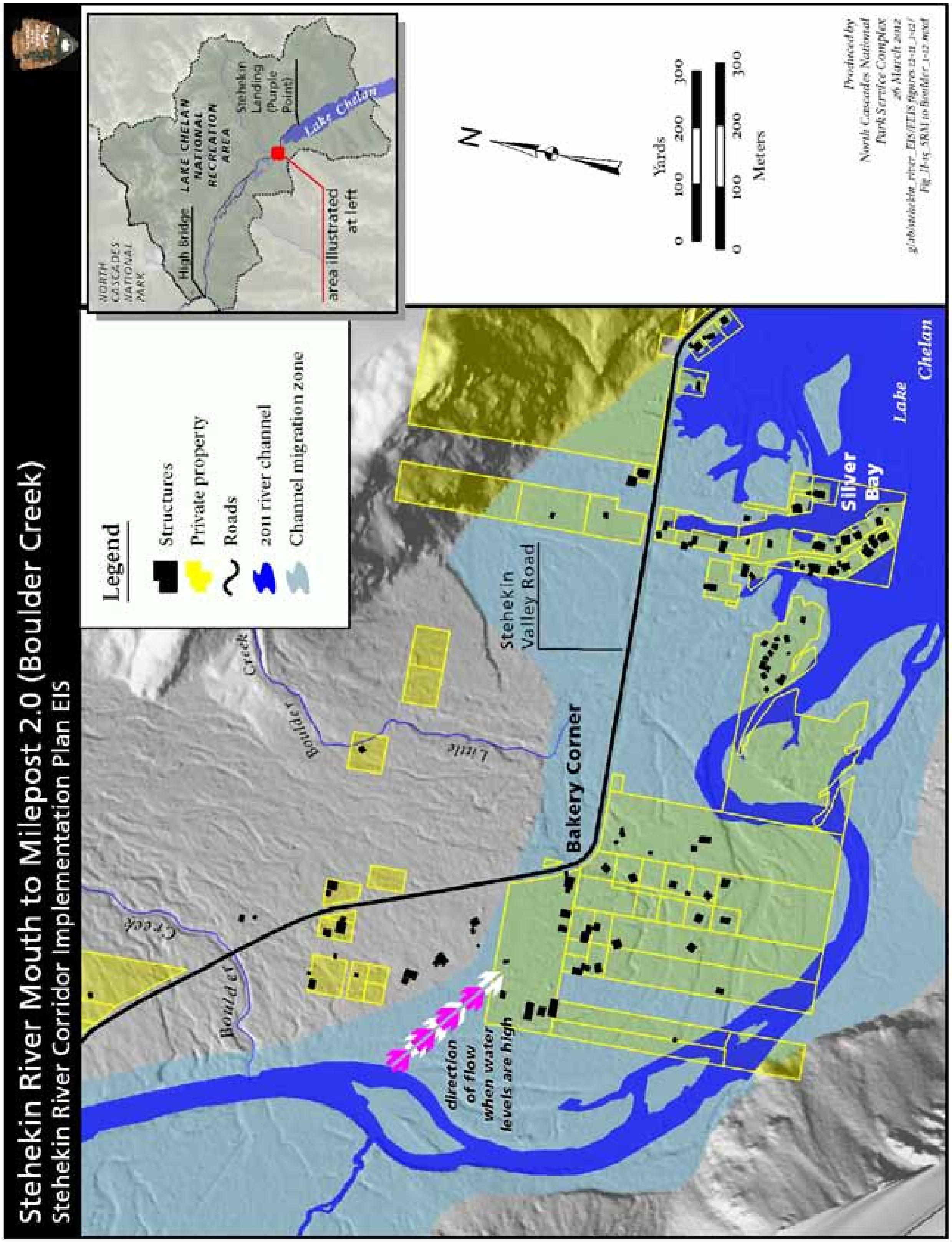
In Alternatives 2 - 5, the natural logjam at this location would be extended on top of the bank and into the forest over a grade-control structure (avulsion sill) constructed beneath it.

Approximately 150 yards below the confluence of Boulder Creek and the Stehekin River, the river has a very low left bank (Figure II-16: *Boulder Creek Erosion Protection Measures under Alternatives 2 - 5*). When water levels are high, water flows over the bank and travels along a low-lying area across the road and under several cabins before returning to Silver Bay (Chelan County 2007). This results in the scouring and/or deposition of material along the road near the Bakery Corner in this location. Past events have required the removal and/or replacement of fill within the road corridor.

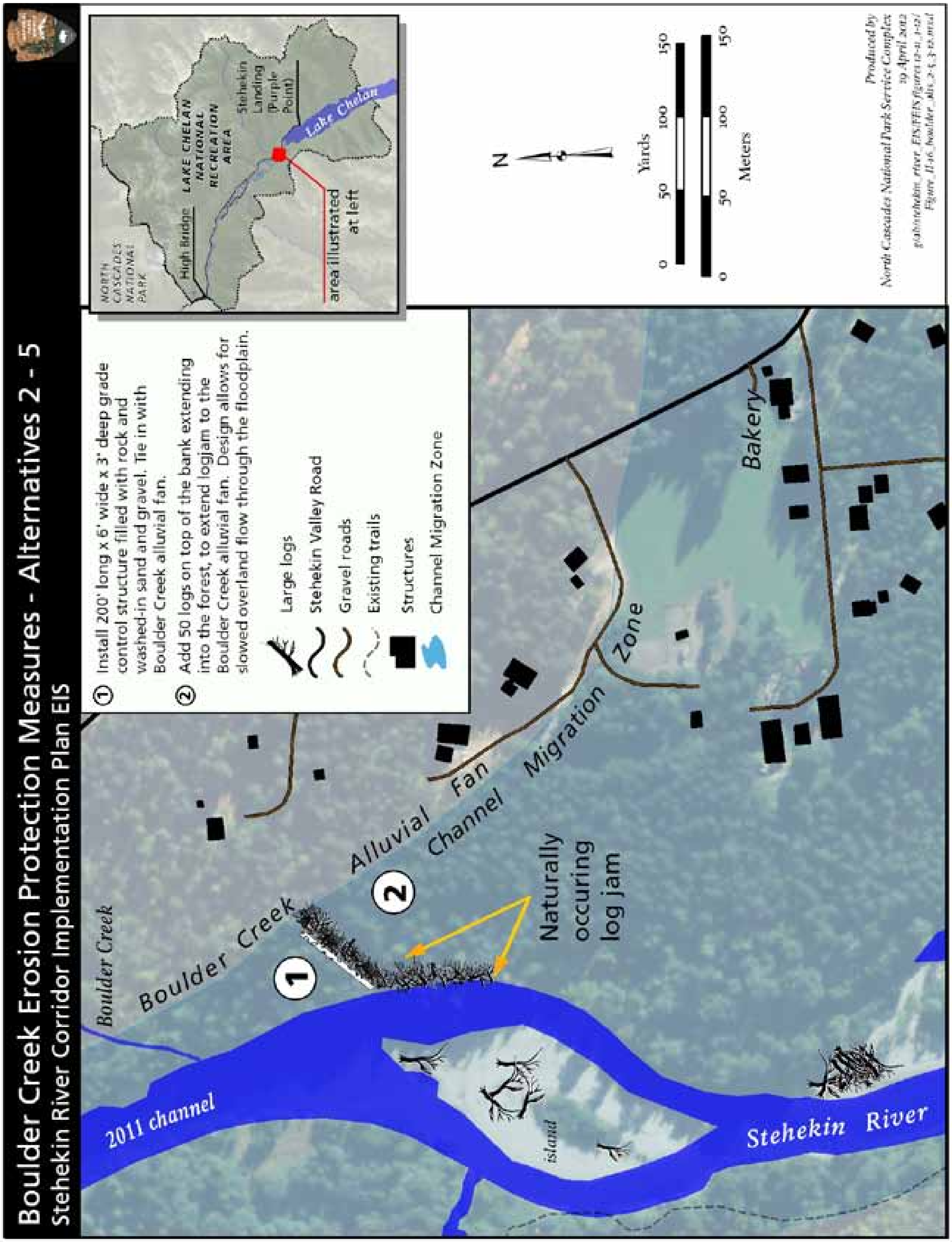
A logjam (200 feet × five feet × three feet) containing approximately 50 large logs would be constructed along the streambank in the forest. It would extend off of an existing natural logjam and would be underlain by a sill of rock (grade-control structure) designed to prevent a major stream channel shift into the densely developed area near the bakery that would also affect the Stehekin Valley Road. The grade-control structure (200 feet × six feet × three feet) would extend away from the river into the forest and tie into the coarse rocks of the Boulder Creek alluvial fan (the total area affected would be about 600 square feet, or 0.01 acre).

The logjam and avulsion sill are intended to slow floodwater heading to the Stehekin Valley Road and NPS housing, but would also steer head-cutting and floodwaters away from other densely populated areas nearby. The logjam would slow floodwater from where the confluence of Boulder Creek and the Stehekin River are combining to flow overland through the forest toward the Bakery area developments, including toward NPS and private housing and the Stehekin Valley Road. River processes here are unnaturally influenced by the Lake Chelan backwater zone, which extends upstream from the lake (Chelan PUD 2000).

**Figure II-15: Stehekin River Mouth / Milepost 2.0, Boulder Creek**



## Figure II-16: Boulder Creek Erosion Protection Measures under Alternatives 2 - 5



## Stehekin Valley Road Buckner Homestead Hayfield and Pasture Restoration

### *Alternative 1: Buckner Homestead Hayfield and Pasture*

There would be no changes to this area, where bank erosion is occurring (see Figure II-17: *River Channel Changes at Buckner Hayfield 1988 - 2011*). Ongoing erosion would likely continue and would eventually need to be treated.

### *Elements Common to Alternatives 2 - 5: Buckner Homestead Hayfield and Pasture*

Native vegetation would be planted to slow bank erosion along the Stehekin River near the Buckner Homestead hayfield and pasture. The left bank (facing downstream) of the Stehekin River is eroding rapidly as the river moves into its left (east) bank. Low-growing grasses and other forbs are not enough to protect this sandy bank in the absence of riparian trees and shrubs, which were removed long ago to create the pasture. In addition to the riparian revegetation, as appropriate, additional plantings would transition away from the river to the pasture.

Three hundred linear feet of bank would be planted with native shrubs and trees, including cottonwood, alder, and red osier dogwood. Oceanspray, wild rose, and snowberry could be planted at the top. The plantings would extend back from the bank for about 30 feet. Small log structures and bioengineering would also be used to slow bank erosion.

## Stehekin Valley Road Milepost 3.8 (Frog Island)

### *Alternative 1: Stehekin Valley Road Milepost 3.8 (Frog Island)*

There would be no changes to this area, where the Stehekin River is undercutting a low terrace between the road and the river. Ongoing erosion would likely continue and would eventually need to be treated.

### *Elements Common to Alternatives 2, 4 and 5: Stehekin Valley Road Milepost 3.8 (Frog Island)*

As the Stehekin River migrates toward the road, it is undercutting a low terrace between the road and the river and is currently within 20 feet of the Stehekin Valley Road.

To slow continuing erosion of the bank, dogwood cuttings were planted, but the river has continued to undermine the bank. Under Alternatives 2 and 5 (one to two rock barbs) and 4 (two rock barbs), and bioengineering, and anchored logs would be installed to slow bank erosion (Figure II-18: *Milepost 3.8 [Frog Island] Erosion Protection Measures under Alternatives 2,4 and 5*).

Construction of the bank barbs would be the same as described above for Weaver Point. Up to an additional 50 cubic yards of rock and large logs (with root wads attached for stability) would be placed between the barbs, at the toe of the bank. About five to six large trees would be anchored with duckbill-type steel anchors and rock along approximately 100 feet of the bank and partly buried. No large (greater than eight inches in diameter) living trees or riparian vegetation would be disturbed during construction, although some forbs and shrubs would be removed to accommodate the work.

## Figure II-17: River Channel Changes at Buckner Hayfield 1988 - 2011

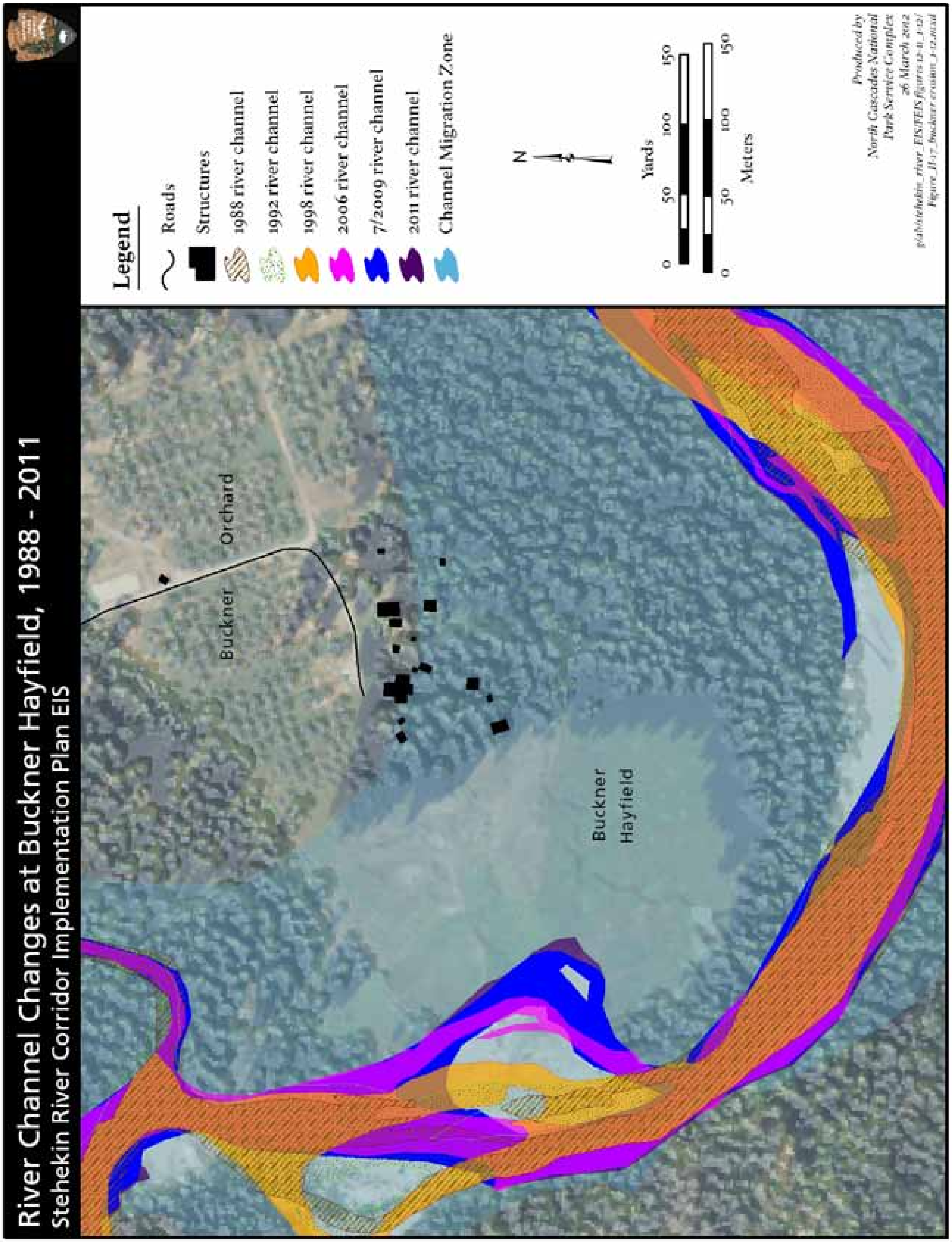
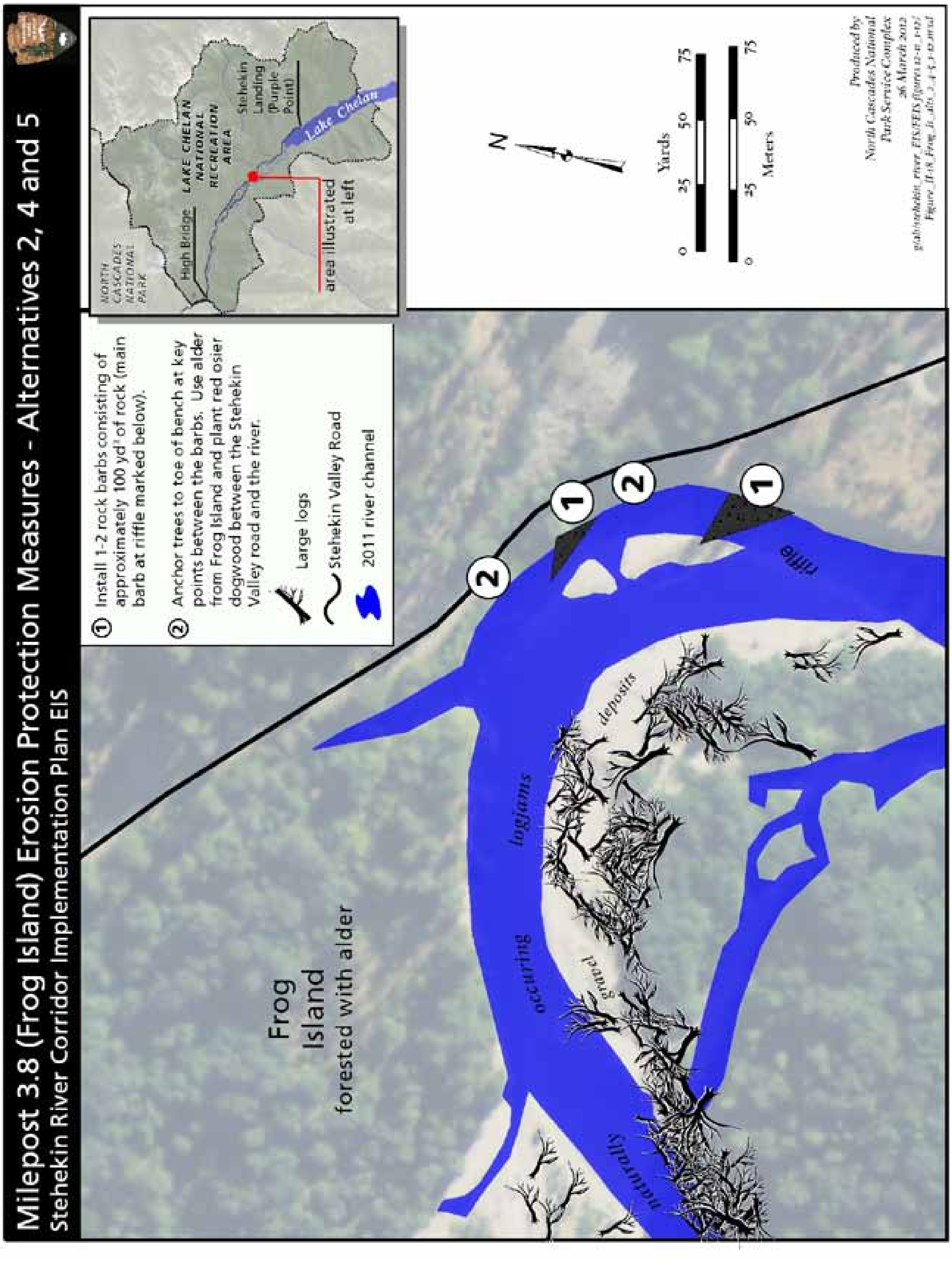


**Figure II-18: Milepost 3.8 (Frog Island) Erosion Protection Measures under Alternatives 2, 4 and 5**



### *Alternative 3: Milepost 3.8 (Frog Island)*

Under Alternative 3, a moderately sized engineered logjam (200 feet × six feet × five feet) would be constructed to stabilize the bank adjacent to the road (rather than using rock barbs, as in Alternatives 2, 4 and 5) (see Figure II-19: *Milepost 3.8 (Frog Island) Erosion Protection Measures under Alternative 3*). As in the proposed logjam for Alternative 3 near the mouth of the Stehekin River, final design would be approved in consultation with a consortium of river rafting guides in a process developed by King County. The logjam would be keyed into the bank by burying several logs and using large rocks to fill in gaps and to anchor logs placed perpendicular to the banks. Construction would occur from the road shoulder and would require vegetation to anchor logs. Plants salvaged from the construction area would be used in revegetation following construction.

## Stehekin Valley Road Milepost 5.1 (Skinny Wilson)

### *Alternatives 1 - 4*

No actions would be taken to stabilize the slumping road shoulder. Decomposing logs currently supporting the road shoulder would continue to cause the shoulder to slump.

### *Alternative 5*

Approximately 40 feet of road shoulder would be stabilized by constructing a rock wall to replace the decomposing logs that currently support the road shoulder. A large big-leaf maple tree (20-inch DBH) at one end of the section would be preserved. The approximately 140-foot long historic rockery wall opposite this area would be not be affected.

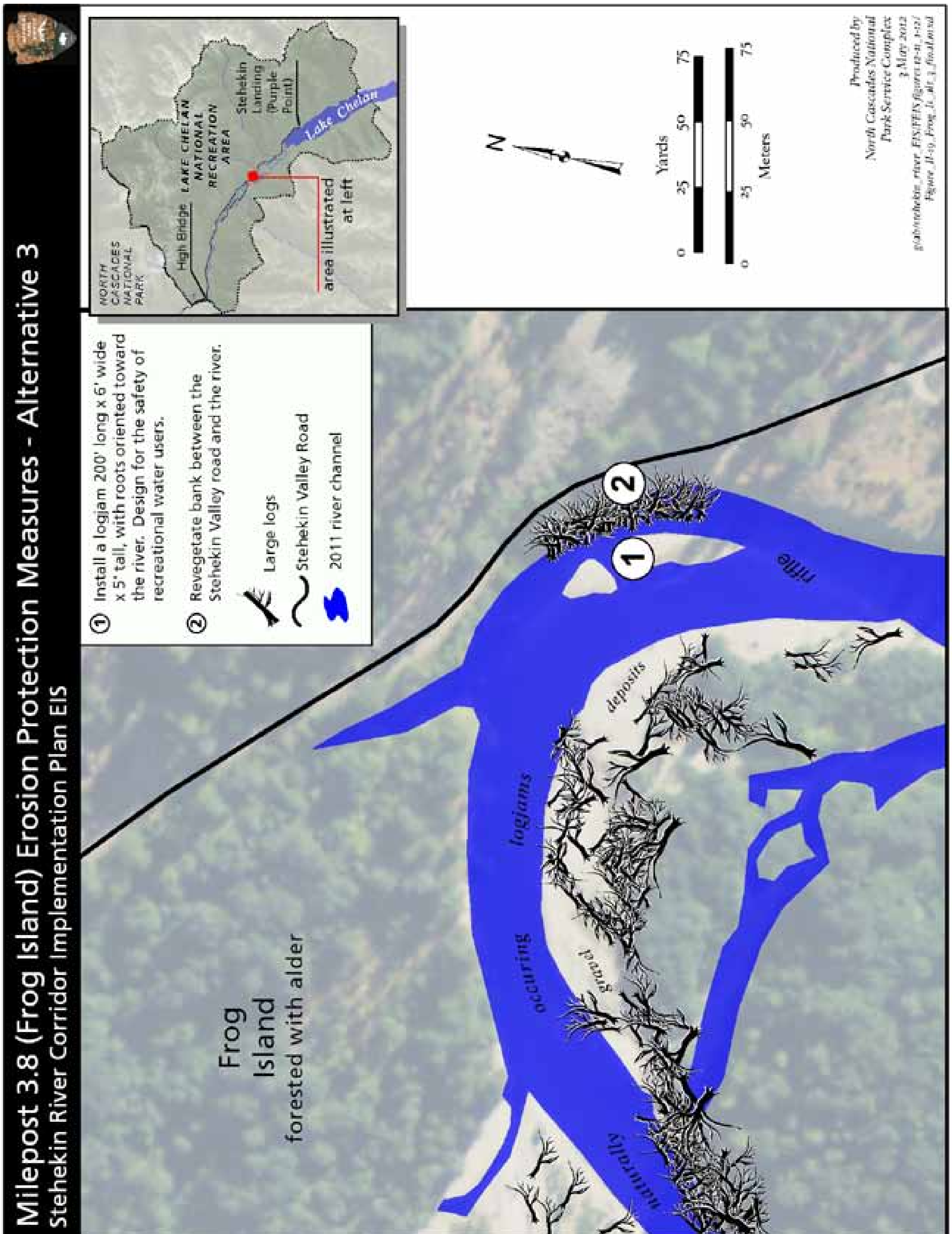
## Stehekin Valley Road Milepost 5.3 (Wilson Creek)

### *Alternative 1*

The slope along the road would be re-graded for approximately 400 feet and the roadbed would be lowered ten feet and moved laterally 15 feet into the hillside as called for by the Stehekin Valley Road Improvement Project.. These actions would also involve installing two new 60-inch culverts and a new ditch. If the road becomes undermined, the road would be rebuilt in place.

In addition, in Alternative 1, the design from the Road Improvement Project would be installed to stabilize the riverbank. The design includes placement of clusters of rip-rap near the toe of the slope and installation of log-cribbing in the mid-slope area. The amount of rip-rap required would be about 100 cubic yards, and 10 - 15 large logs would be used for the cribbing. Construction would be from the base of the slope and would likely require access across private land downstream, including an easement or purchase. The NPS would work with the landowner to identify appropriate mitigation and/or compensation for impacts, such as an easement or purchase. If an easement could not be obtained or a purchase did not occur, the road would be shifted into the hillside and would remain unpaved. This would likely extend the time before additional damage to the road by the river occurs.

**Figure II-19: Milepost 3.8 (Frog Island) Erosion Protection Measures under Alternative 3**



### *Elements Common to Alternatives 2, 4 and 5: Stehekin Valley Road Milepost 5.3 (Wilson Creek)*

Instead of lowering the road ten feet (as in Alternative 1), it would be raised (up to four feet) at the downstream end and realigned slightly into the cut slope. Instead of the rip-rap and log-cribbing in Alternative 1, Alternatives 2, 4 and 5 would construct two to three rock barbs and revegetate the slope with willow layering (see Figure II-20: *Milepost 5.3 (Wilson Creek) Erosion Protection Measures under Alternatives 2, 4 and 5*). Some rock could be placed in select areas to supplement natural bank armoring. As in Alternative 1, this would require an easement or purchase. As in Alternative 1, if an easement could not be obtained or a purchase did not occur, the road would be shifted into the hillside and would remain unpaved.

### *Alternative 3: Stehekin Valley Road Milepost 5.3 (Wilson Creek)*

The road would be raised slightly as in Alternatives 2, 4 and 5 to accommodate larger culverts. A moderately-sized engineered logjam (400 feet × six feet × ten feet) using approximately 300 logs would be constructed (see Figure II-21: *Milepost 5.3 (Wilson Creek) Erosion Protection Measures under Alternative 3*). As in other logjam designs, final design would be approved in consultation with river rafting guides. The log structure would be keyed into the bank by burying several logs and using large rocks to fill in gaps and to anchor logs, with cables connecting logs. Construction access would be the same as in Alternative 1, and would require the NPS to purchase an easement or land from the private landowner. As in other alternatives, if an easement could not be obtained or a purchase did not occur, the road would be shifted into the hillside and would remain unpaved.

## Stehekin Valley Road Milepost 7.0

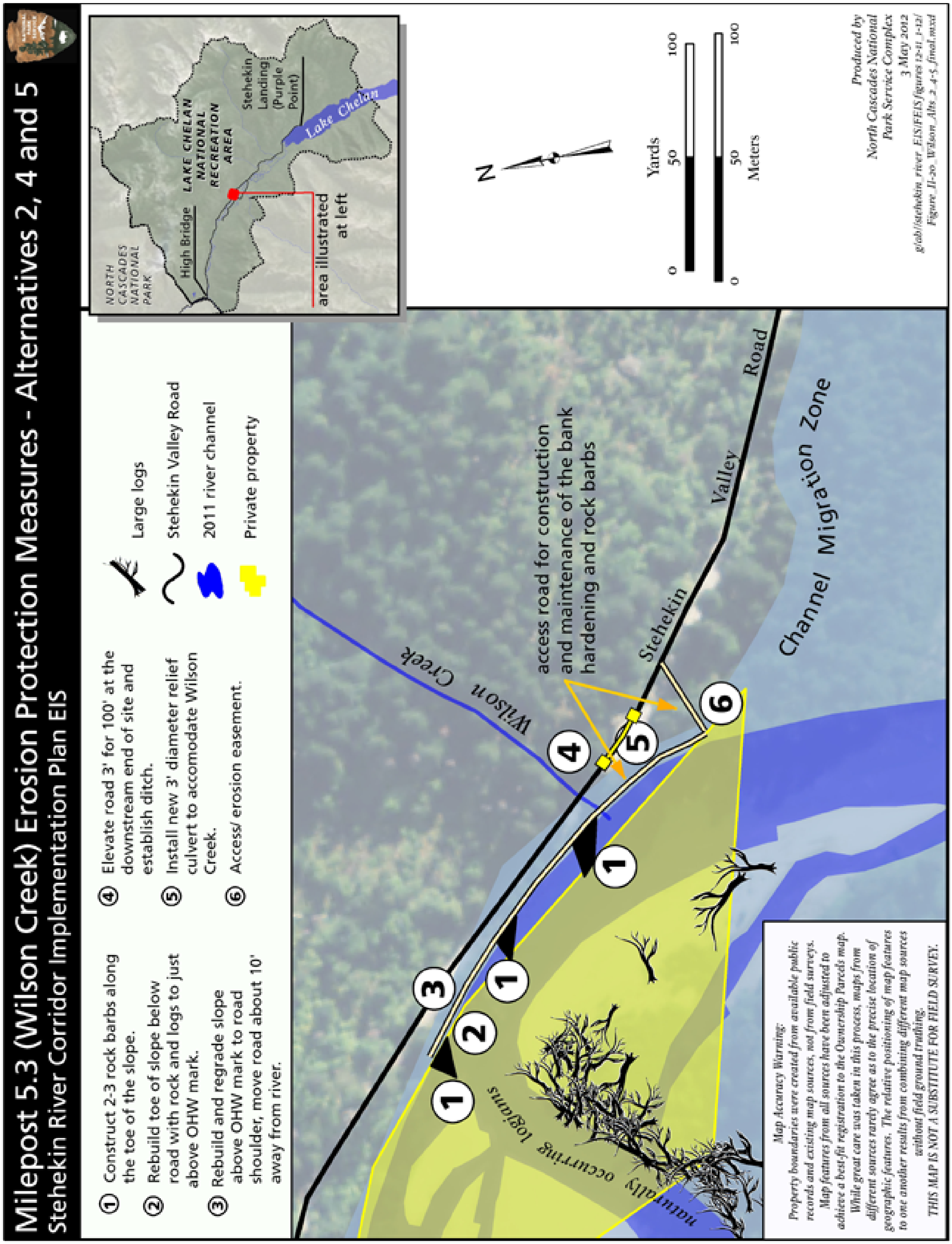
### *Alternative 1: Stehekin Valley Road Milepost 7.0*

The three grade-control structures installed after 2006 flooding would continue to be maintained in this alternative. These structures are in place to prevent the river from following the road through McGregor Meadows. If the river flowed down the road into McGregor Meadows, it could cause erosion of road gravel and flooding of private development there, contributing to adverse effects on the Stehekin River from release of contaminants from septic system drain fields and from other potentially harmful contaminants located within potentially flooded developed areas. Road flooding would also preclude vehicle access to NPS campgrounds and trails and private residences, as well as public land, upvalley.

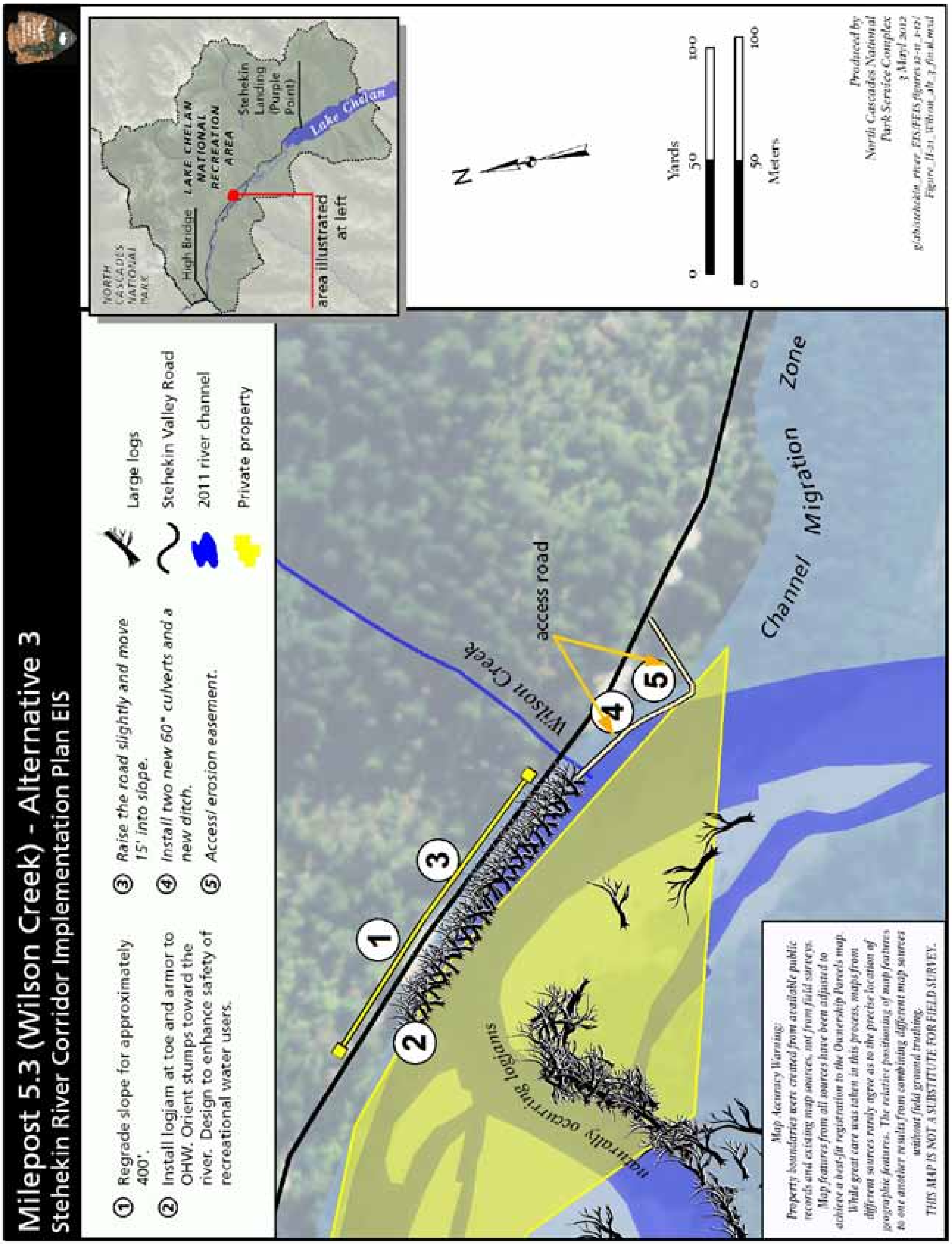
### *Elements Common to Alternatives 2, 3 and 5: Stehekin Valley Road Milepost 7.0*

The grade-control structures would be maintained to protect the McGregor Meadows Access Road, even though the Stehekin Valley Road (reroute) would bypass this area. The access road into McGregor Meadows up to Milepost 6.5 would continue to be used. If major road failure occurred from a catastrophic river avulsion (major channel shift) and loss of major sections of road occurred and affected private property access, the NPS would work with private landowners to determine how to restore access across federal land, if needed, or to encourage land exchange, if appropriate. Landowners would continue to be responsible for maintaining access roads on their property.

**Figure II-20: Milepost 5.3 (Wilson Creek) Erosion Protection Measures under Alternatives 2, 4 and 5**



## Figure II-21: Milepost 5.3 (Wilson Creek) Erosion Protection Measures under Alternative 3



Whether restoration of access would include rebuilding the access road, rerouting, or some combination of these would be determined as it has been, on a case-by-case basis, and would be designed to limit impacts to Lake Chelan NRA resources.

### *Alternative 4: Stehekin Valley Road Milepost 7.0*

Actions would be the same as in Alternative 1, plus two rock barbs would be constructed to protect this portion of the Stehekin Valley Road.

## Stehekin Valley Road Milepost 7.3 to 7.4 (Lower Field)

### *Alternative 1: Lower Field*

The Stehekin Valley Road would remain along the edge of the Lower Field.

### *Elements Common to Alternatives 2 - 5: Lower Field*

Riparian restoration would be implemented along a 30-foot-wide strip, approximately 200 feet long, beginning from the Stehekin River bank and continuing back toward the road. Approximately 15,840 square feet (0.36 acre) would be restored with native vegetation, including seeding and planting. Large logs would be anchored to the bank to slow erosion until vegetation became established.

### *Elements Common to Alternatives 3 and 4: Lower Field*

In addition to the riparian restoration described above, two rock barbs and bioengineering would be added to maintain the adjacent Stehekin Valley Road alignment along the Lower Field. The rock barbs and bioengineering would increase bank stability in this area, an action needed because the reroute would not continue around Lower Field (Alternative 3) and because Alternative 4 would not have a reroute.

## Stehekin Valley Road Milepost 7.8 (Thimbleberry Creek)

### *Alternative 1: Thimbleberry Creek*

The road would be raised slightly and the 72-inch Thimbleberry Creek culvert and two new 48-inch culverts would be retained. Debris racks on the culverts would minimize their filling with sediment.

### *Elements Common to Alternatives 2 - 5: Thimbleberry Creek*

The road would be raised slightly and the Thimbleberry Creek culverts would be replaced, with the 72-inch culvert and the twin 48-inch culverts replaced two 60-inch culverts. A ditch would then be excavated to connect the two new culverts. Debris racks on the culverts would minimize their filling with sediment.

## Stehekin Valley Road Milepost 8.0

### *Alternative 1: Stehekin Valley Road Milepost 8.0*

At Milepost 8.0 the Stehekin Valley Road is cut into a 50-foot-tall, steep, unstable slope along the edge of a glacial moraine studded with large boulders. Large rocks and debris frequently fall down this slope onto the road, creating a safety hazard and recurring road maintenance problem. In Alternative 1, ongoing monitoring of the steep, unstable slope adjacent to the road would continue.

### *Elements Common to Alternatives 2 - 5: Stehekin Valley Road Milepost 8.0*

In Alternatives 2 - 5, slope stabilization in this area would be improved. In addition to maintaining existing barbs and bioengineering on the river side of the road, stabilization of the raveling slope above the road would be improved by re-grading portions of the steepest upper part (approximately the top one fourth to one third of the slope, in some places to a depth of ten feet) to an angle of less than 40 degrees. Rocks on the slope would be scaled off (removed) and the slope would be planted with native shrubs. A rockery wall (100 - 150 feet long and three to eight feet high) would also be added at the base of a portion of the slope. In addition, some rip-rap could be placed in the upper, finer-grained portion of the road embankment. As noted earlier, if the road is undermined further, it would be rebuilt in place (see "D. Alternatives and Actions Considered but Dismissed"). (This would minimize or avoid impacts to northern spotted owls and to cultural resources, including Stehekin Wagon Road segments potentially eligible for the National Register of Historic Places.)

## Stehekin Valley Road Milepost 8.5

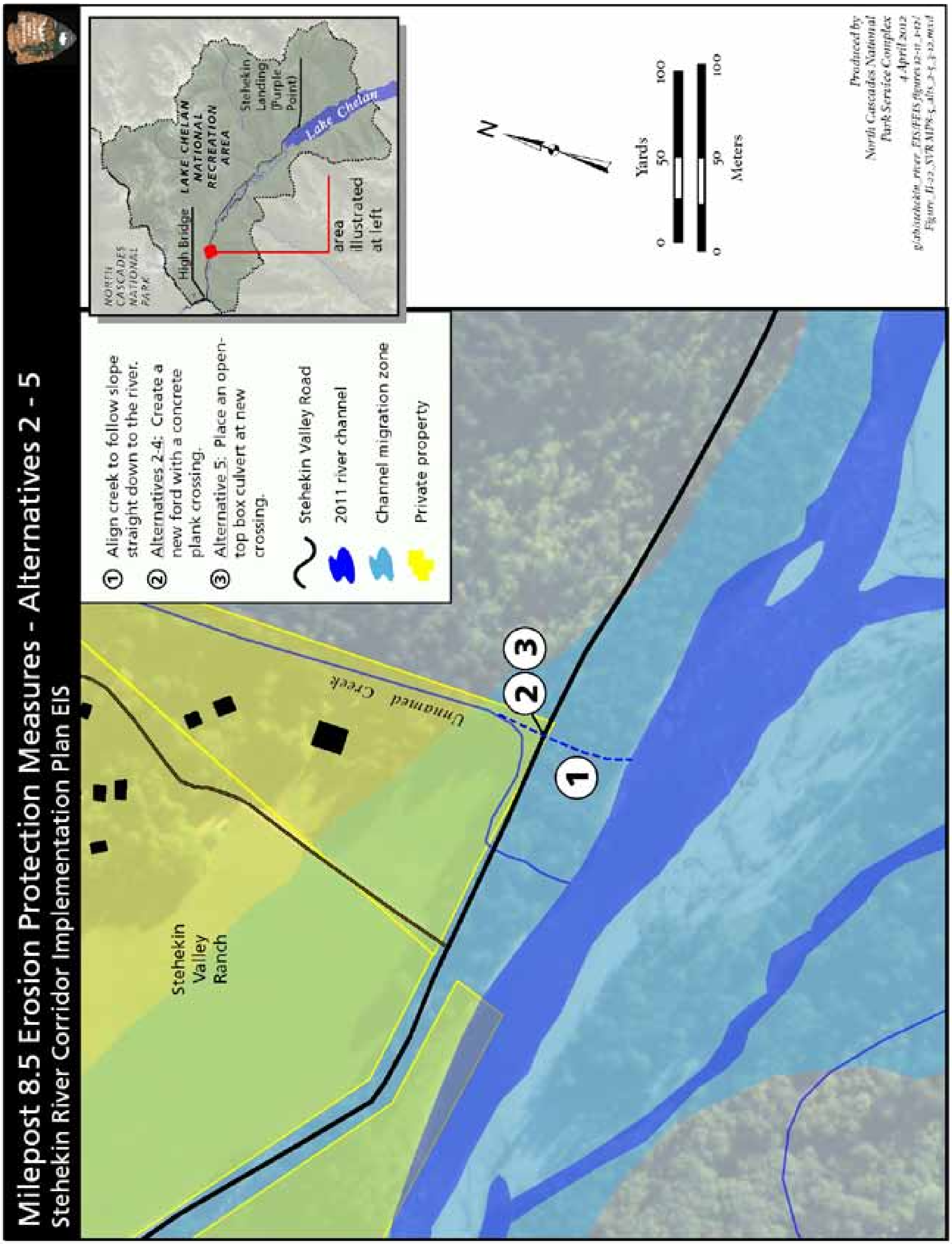
### *Alternative 1: Stehekin Valley Road Milepost 8.5*

As described in the Road Improvement Project, the existing culvert would be realigned to meet an unnamed creek where it comes down off the hillside, rather than forcing it parallel to the road (at a 90 degree angle to the culvert) and then under the road. The unnamed creek is located near the Stehekin Valley Ranch and hits the road at a right angle before turning and flowing west, parallel to the road, in a constructed ditch, where it is forced by adjacent boulders to turn 90 degrees into a culvert. Because of the angle where the creek meets the road, large quantities of sand and gravel plug the culvert and cause water to flow over the road, depositing debris on the roadway (NPS LACH 2005a:24). Under Alternative 1, the culvert would be moved downvalley so that the creek flows directly under the road without making two 90-degree turns.

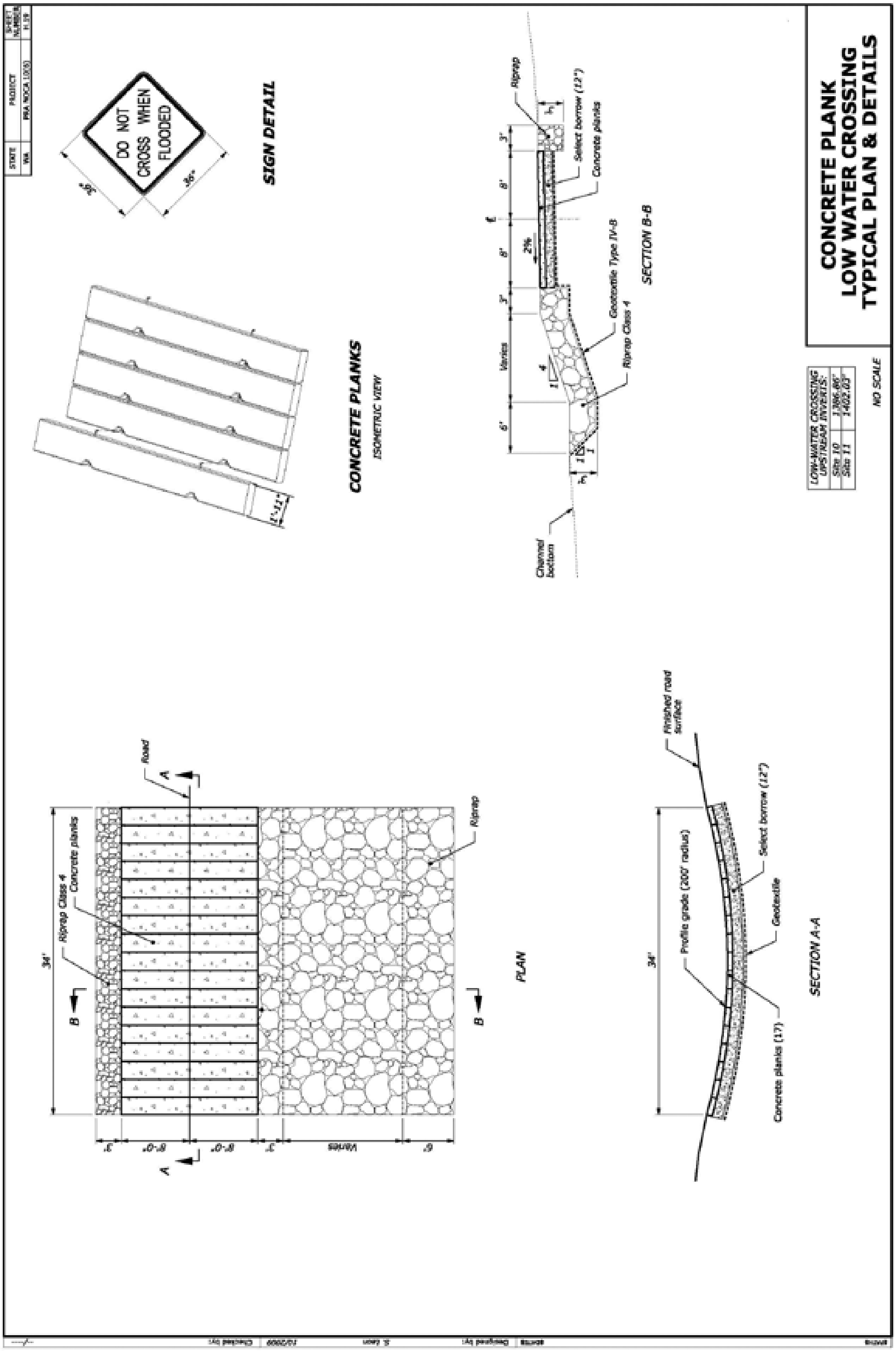
### *Elements Common to Alternatives 2 - 4: Stehekin Valley Road Milepost 8.5*

The misaligned culvert would be replaced with a low-water crossing (approximately 34 feet long) over the road where the creek flows off the hillside, so that the creek would be aligned with the construction of the low-water crossing (Figure II-22: *Milepost 8.5 Erosion Protection Measures under Alternatives 2 - 5* and Figure II-23: *Low-Water Plank Crossing*). This would direct flow over the road into the Stehekin River without impacting the road shoulder or road base or continuing to modify the creek channel. Water would flow through an excavated channel to the Stehekin River.

**Figure II-22: Milepost 8.5 Erosion Protection Measures under Alternatives 2 - 5**



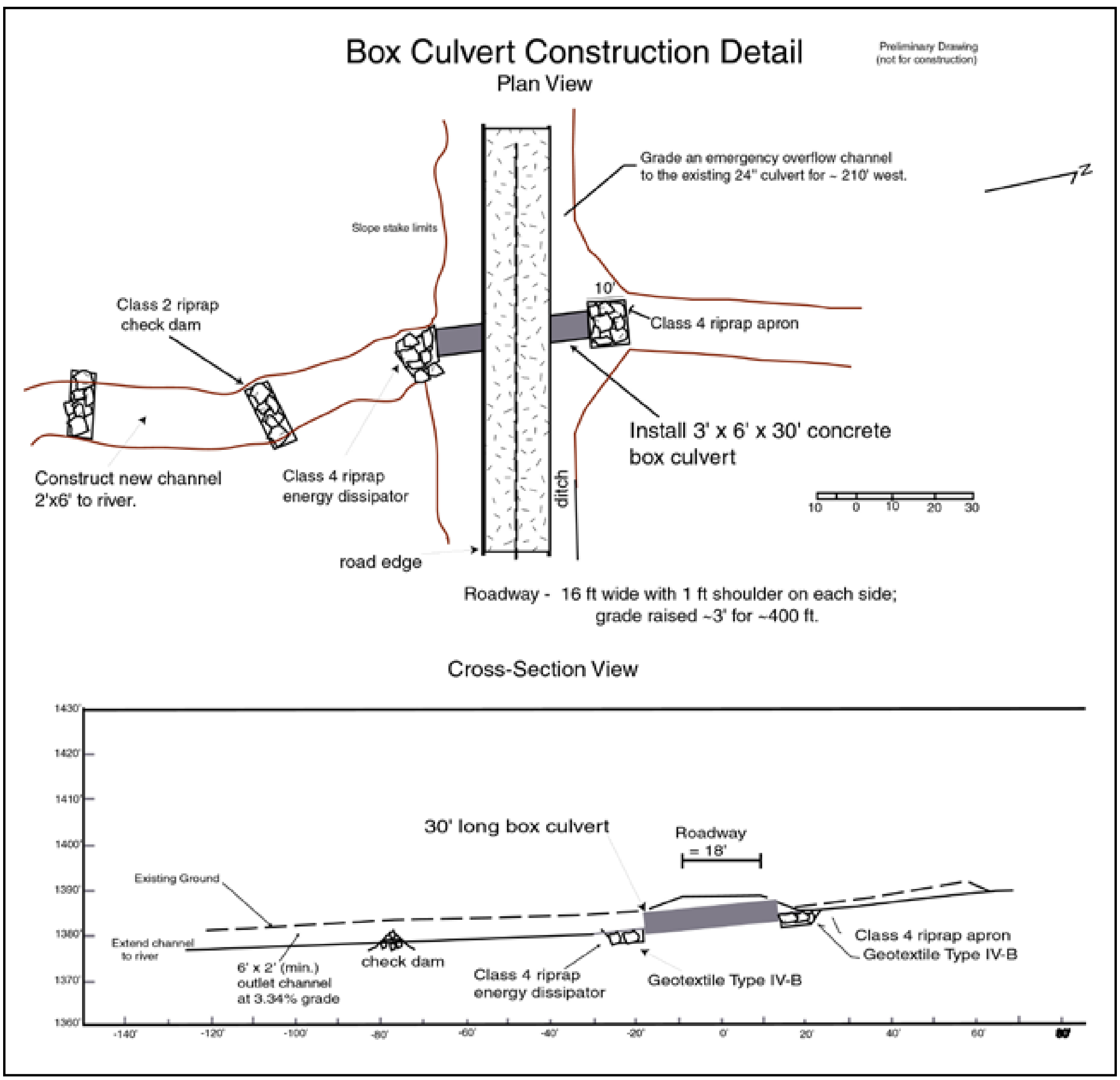
## Figure II-23: Low Water Plank Crossing



### *Alternative 5: Stehekin Valley Road Milepost 8.5*

Instead of a low water crossing, a box culvert or another bicycle-friendly water flow device would be used and the road grade would be raised three to four feet over a distance of approximately 450 feet (Figure II-24: *Stream Crossing Design at Milepost 8.5 under Alternative 5*). A box culvert three to four feet x six feet x 26-30 feet, with pre-cast concrete wing walls and a removable grate, would be installed. To facilitate water reaching the Stehekin River, an outlet relief channel six feet x three feet x 100 feet (following the natural channel) would be created (to minimize tree impacts, this route would be through an existing gap in the trees). Rather than lining this channel with rock at the intersection with the Stehekin River, rip-rap check dams would be used to slow the flow. Instead, the excavated relief channel would be lined with coir fabric and natural substrate and revegetated. To reduce the number of trees impacted, the road would be

**Figure II-24: Stream Crossing Design at Milepost 8.5 under Alternative 5**



lowered as soon as possible on the upvalley side. Therefore, actions may be required to protect some large cottonwoods near the intersection with the private road. Some, however, may need to be removed. Other trees would also be removed to create the outlet channel. A culvert would also be installed near the entrance to the private property access road if the grade is raised. An existing 24-inch culvert would be cleaned and retained.

### Stehekin Valley Road Milepost 9.2

#### *Alternative 1: Stehekin Valley Road Milepost 9.2*

Following rapid bank erosion just upstream during the 2006 flood, two grade-control structures were installed where the road meets the river. In summer 2009, a storm cell dropped a significant amount of rain over the area and caused a debris flow, which rerouted the creek onto the road. Water followed the road to the Stehekin Valley Ranch, depositing silt and sand on the private pastureland and the road.

In Alternative 1, ongoing monitoring of the threats to Stehekin Valley Road would continue, and existing grade-control structures that limit the potential for water to create a channel in the road corridor would be maintained. No action would be taken to address seasonal flooding. Ponding of water on the roadway would continue.

#### *Alternatives 2, 3 and 5: Stehekin Valley Road Milepost 9.2*

Actions would be the same as in "B. Actions Common to All Alternatives (1 - 5)." In addition, in Alternatives 2, 3 and 5, approximately 600 feet of the Stehekin Valley Road would be elevated approximately three feet above grade (it is now one foot below grade). This would require about 500 cubic yards of clean fill. Another 50 cubic yards of fill would be used to construct a new parking area on the east side of the road to accommodate four vehicles. A two- to three-foot-deep ditch dug along the road above the parking area would direct water to a culvert and new concrete plank low-water crossing (approximately 34 feet long). A series of berms to redirect water would also be constructed near the parking area.

#### *Alternative 4: Stehekin Valley Road Milepost 9.2*

In addition to actions described in Alternatives 2, 3 and 5, three rock barbs and bioengineering would be constructed just upstream of Milepost 9.2. The rock barbs and bioengineering would limit additional loss of land between the road and the river.

## D. ALTERNATIVES AND ACTIONS CONSIDERED BUT DISMISSED

Under the NEPA (40 CFR 1502.14 (a)), CEQ's Frequently Asked Questions and NPS Director's Order 12, alternatives may be eliminated from detailed study based on the following reasons:

- Technical or economic infeasibility;
- Inability to meet project objectives or resolve need for the project;

- Duplication of other less environmentally damaging alternatives;
- Conflicts with an up-to-date valid plan, statement of purpose and significance, or other policy; and therefore, would require a major change in that plan or policy to implement; and
- Environmental impacts too great.

The following alternatives or variations were considered during the design phase of the project, but because they met one or more of the above criteria, they were rejected.

### *Allow use of the Airstrip for Exchange to Relocate Private Property Outside of the Floodplain.*

This action conflicts with the following GMP provision:

> *The airstrip would be retained and operated under a special use permit with the Washington State Department of Transportation, Aeronautics Division, for noncommercial public use on a "use at your own risk" basis.* (NPS LACH 1995a:33)

The airstrip area was also designated in the GMP as the location for the relocated maintenance compound / housing area. There is also not enough room in this location to accommodate the airstrip, NPS maintenance compound, NPS housing and additional exchange parcels. A small part of parcel 06-110 (the former Peterson property near the upper end of the airstrip) has been identified for exchange, depending on NPS use for the maintenance / housing.

### *Implement Additional Flood Protection (Bank-Hardening) Measures, such as Rip-rap or Levees, along the Banks of the Stehekin River to Prevent Flooding.*

Additional rip-rap was considered but rejected in favor of bank barbs and engineered logjams because

- Rip-rap is known to have substantial adverse impacts to riparian areas and stream banks.
- Rip-rap is expensive because rock has to be imported into the Stehekin Valley.
- Rip-rap would cause more riverbank modification (channelization of the river) compared to rock barbs or logjams.
- Rip-rap can increase accelerate erosion downstream.
- NPS and GMP management direction is to avoid hard armoring of riverbanks. NPS has successfully avoided use of large amounts of rip-rap in favor of using rock barbs, large wood, and bioengineering.
- Rip-rap would not meet the GMP goal of maintaining the river in its natural state as much as possible (NPS LACH 2005a).

### *Implement Additional Erosion Protection Measures at Buckner Homestead Hayfield and Pasture.*

The proposed riparian restoration and use of small wood structures at this location is likely to slow erosion of the bank. Additional erosion protection measures could be considered later if warranted.

### *Exchange Lands to Allow Private Landowners to Establish or Maintain Flood and/or Erosion Protection.*

This strategy was initially considered under the following scenario: Allow exchange of the affected parcel under specific conditions, including when (1) no development would be permitted, (2) beneficial erosion control measures would be implemented, and (3) the exchanged property had limited resource value and the acquired property had high resource value. It was rejected because it blurs the line between the NPS allowing actions on its own property to protect private property, as specifically prohibited by the GMP and generally by NPS policy.

### *Take Action as Part of the Plan Solely to Protect Private Property.*

The NPS is prohibited from expending funds solely to protect private property. Actions that protect NPS administrative facilities and infrastructure may, however, have the inadvertent and indirect benefits of also protecting private property. Other federal agencies, such as FEMA and the Army Corps of Engineers, have the authority to spend public funds to protect private interests, but the NPS does not have this authority.

### *Reroute the Stehekin Valley Road at Milepost 8.0.*

This action was considered but rejected based on the following reasons: (1) upland impacts would be great, (2) the area has been stabilized by recent implementation of erosion protection measures, (3) there would be unacceptable cultural resources impacts (affecting the integrity of what remains of a historic dry-laid rock wall along the Old Wagon Trail [determined eligible for the National Register]), (4) the reroute would affect a larger area of northern spotted owl habitat and would therefore have a high resource cost, (5) to reroute at this location would conflict with decisions made in previous planning documents (Stehekin Valley Road Erosion at Mile 8.0 1993 Environmental Assessment / Finding of No Significant Impact), and (6) the reroute could require a very expensive rock wall and major blasting in bedrock (NPS LACH 2008a).

### *Reestablish the Southside Stehekin Valley Road along the Company Creek Road Alignment, including Constructing a New Bridge.*

This action was considered but rejected for the following reasons: (1) the Company Creek Road would have to be widened considerably to accommodate sight distance needs, (2) the road alignment would continue to be subject to more flooding than the existing Stehekin Valley Road, (3) it would be very expensive to construct a second bridge, (4) there would be impacts to floodplain from fill needed in Lower Field to reach the bridge, and (5) there are no official easements in place for maintaining a road corridor through this area. If the road were widened, there would be no room for snow storage. Recent flooding has inundated much of the road at lower magnitudes than affect the Stehekin Valley Road, including the area between Harlequin Bridge and the current maintenance compound and after the road passes through the Company Creek alluvial fan (NPS LACH 2008a).

### *The Scope of the Plan should Encompass the Entire Stehekin River Watershed, including the Area above High Bridge.*

Areas above High Bridge are primarily located in wilderness, and there are limited actions that could be taken without altering the wilderness character or boundary. In addition, the Agnes

Creek watershed represents about one-third of the Stehekin Basin and is managed by the USFS. The scope of the SRCIP was limited to focus on the problems caused by the 2003 and 2006 floods in the lower valley and to the Lower Stehekin Valley below High Bridge, where private property is threatened by flooding. Since the floor of the lower valley below High Bridge is outside of designated wilderness, the NPS has more options to relocate roads and facilities, to exchange lands, and to construct erosion protection measures. The entire watershed was considered when assessing the hydrology of the lower river as well as sources of sediment.

### *Sediment and Large Woody Debris Sources above High Bridge and/or in the Whole Stehekin Watershed should be Evaluated for Treatment.*

The NPS assessed a number of features across the watershed, including landforms, such as landslides, river canyons, alluvial fans, etc. The gauging station also integrates runoff from the entire watershed, and wood and gravel movement to, and storage within, the lower valley are a result of integrated watershed processes. Sources of gravel include landslides, river cut banks, alluvial fans, debris cones, and hundreds of other features. Most of the upper Stehekin River watershed is designated wilderness, where any large-scale erosion protection treatment would not only be extremely costly and difficult to achieve, but would employ management actions not permitted in wilderness.

### *The Stehekin River should be Contained within a Channel to Reduce Flooding of Private Property and Public Facilities.*

Containing the Stehekin River within a channel would not conform to NPS *Management Policies 2006* (NPS 2006a), which advocates allowing rivers to migrate naturally within their floodplain. Trying to keep the river from occupying parts of its floodplain would likely only be a temporary solution given the massive amounts of water, gravel, and wood that this mountain river transports. As a result, this action would be unlikely to be funded by NPS. Such an approach would adversely affect private land, public facilities, and ecological values and would be of questionable benefit over the medium to long term.

### *The Plan should include Actions that would Resolve Issues in the Whole Lower Valley.*

While the plan does address issues related to flooding of public and private property in the Stehekin corridor in many areas, it cannot solve all the flooding problems in the lower Stehekin Valley, particularly since flooding is getting worse. This alternative is beyond the scope of the proposed plan as well as funding and NPS *Management Policies*.

### *The Goal of the Plan should be to Allow Natural Processes to Occur Unimpeded so that Natural Flooding can Continue to Occur without Regard to its Effect on Facilities and Private Property.*

In establishing Lake Chelan NRA, Congress recognized the significance of the Stehekin Community, which plays a central role in enabling recreational use of the area. The NPS is in a unique position to foster sustainable management strategies for the Stehekin Valley because it manages most of the land in the lower valley. Because the Stehekin River flows through a mix of public and private land, it is not possible to allow natural processes to continue wholly unimpeded. Frequent flooding and occasional destruction of cabins and inundation of drain fields and septic tanks represent serious threats to water quality, the ecological integrity of the river, and scenic values. In addition, incorporation of glass, metal, plastic, and other debris from development into the river system would cause long-term damage to natural and cultural resources values. The enabling legislation for Lake Chelan NRA recognizes that people will continue to live and work within the area. Nonetheless, NPS *Management Policies 2006* (NPS 2006a) directs the NPS to allow natural processes to occur to the extent possible.

Allowing the Stehekin River to migrate naturally within its floodplain is, in fact, one of the goals of the SRCIP. While this may be difficult to achieve throughout the valley given the way in which public and private property intertwine, it is one of the constraints within which the NPS must continue to work. Focusing on the goal of removing development from the channel migration zone will achieve the purpose of allowing the river to migrate as naturally as possible within its floodplain. Ignoring the public and private facilities that do exist would have adverse effects on both Lake Chelan NRA and the Stehekin Community.

#### *Plan Alternatives should include Consideration of Rerouting the Company Creek Road.*

Rerouting the Company Creek Road was considered and dismissed in the 1995 GMP. As a result, additional analysis of this issue was considered but dismissed as part of this planning effort. The intent of the SRCIP is to implement, rather than amend, the GMP. Rerouting the road would result in major disturbance of previously undisturbed areas, particularly when considering the need for private access off the Company Creek Road. NPS actions in the past 15 years have increased bank stabilization along the road. Relocation of the road could also leave private landowners to seek their own solutions to bank erosion.

#### *Excess Materials, including Large Woody Debris and Excavated Gravel, Generated by the Plan should be used for Other Public and Private Projects in Stehekin.*

#### *Use Suitable Gravel for Projects in the Valley Instead of Importing Materials at High Cost.*

#### *Pile Burning or Consumptive Use of Large Woody Debris Generated by the Plan should be Considered.*

#### *The Plan should Consider Changes to the Sand, Rock, and Gravel Plan to Allow Use of Gravel Generated by Plan Actions.*

NPS Management Policies have very strict guidelines regarding the consumptive use of NPS resources. Consumptive uses of resources in Stehekin have previously been addressed by the *Sand, Rock, and Gravel Plan* and other plans, such as the Fire Management Plan (NPS LACH 1995e).

No changes to the *Sand, Rock, and Gravel Plan* are needed to allow the use of materials generated by the proposed alternatives. To the extent possible, the proposed road improvement projects in Stehekin would balance cut and fill materials to avoid importation of large amounts of similar materials. In some alternative actions, gravel would need to be imported because of the unsuitability of material produced by the Company Creek Pit and because the amount of material needed would exceed the amount specified by the *Sand, Rock, and Gravel Plan*. In this plan, some material identified as excess and unsuitable for park needs would be used.

The SRCIP addresses changes in the management of large woody debris; however, continuing to retain that large woody debris as part of the valuable aquatic resource that it is in the Stehekin River system is one of the basic tenets of the proposal. Removing large amounts of woody debris or rock from the Stehekin River for consumptive uses outside the channel migration zone would adversely affect these and other Lake Chelan NRA resources. Some materials from the Company Creek Pit now considered reject rock, because of size, however, would likely be used for proposed work in this plan.

### *Gravel Removal should be Used Instead of Land Exchanges.*

### *Dredging should be Part of the Plan as Long as it is Done in a Way that Minimizes Impacts.*

Removal of gravel from the floodplain of the Stehekin River would be an expensive and long-term undertaking. While selective gravel removal is one potential way to manage the Stehekin River over the short term, it generally does not conform to NPS *Management Policies 2006* or represent a fiscally or ecologically sustainable option due to the amount of gravel. The cost of this action, in terms of dollars and ecological values or associated with private land and public facilities is prohibitive. For example, the ACOE and the NPS estimate that to remove about 100,000 cubic yards of gravel from two one-kilometer-long stretches of the river would cost an estimated $12 million (see Appendix 18: *Estimates of Gravel Accumulation in Two Reaches of the Stehekin River*). This would then need to be periodically repeated to remove gravel the river would move back in. At the McGregor Meadows Reach, it is estimated that 150,000 cubic yards of gravel have been deposited since the mid-1980s, making continued removal both costly

Photo 13 – Stehekin River at proposed raft access (mouth upstream of the river resort).

and ineffective. It is also unclear how it could be undertaken based on initial analysis of the magnitude of gravel removal that would need to be repeated over time. At the Stehekin River mouth, repeated channel surveys indicate that some gravel is being transported into Lake Chelan. The most effective flood-control action in this area would likely be to have Lake Chelan drawn down during potential seasonal flooding and the flooding to flush gravel into the deepest part of the lake. If NPS decided to remove gravel from the Stehekin River channel, and the permitting agencies approved it, removal from the river bed could only occur when gravel bars are exposed during late summer low-flow periods. This coincides with the primary visitor use season and the process would have long-term adverse effects that would be highly disruptive to those visiting the Stehekin Valley.

#### *Reroute the Stehekin Valley Road at Milepost 9.2.*

Although a reroute was initially considered at Milepost 9.2, this idea was discarded in favor of an alternative that would have many fewer impacts and still solve the problem of periodic water flow across the road (constructing a concrete plank crossing).

#### *Lower Field Land Exchange*

The Lower Field would not be made available for exchange in the version of the LPP accompanying the SRCIP. Although the Lower Field is expected to remain in agricultural use, it is inappropriate to offer it for exchange because it is within the channel migration zone and future movement of the river in that direction could place a future property owner at risk. Due to a lack of development in this area it also does not meet the NPS goal to cluster development and it is valued for its wildlife habitat (open space). Instead, the Lower Field would continue to operate under a special use permit for agricultural purposes to maintain the open character of the former landscape associated with the Maxwell Homestead.

#### *Lower the Stehekin Valley Road at Wilson Creek*

Lowering the road would alter the grade of the road and would result in a large dip because fill is being added to locate larger culverts. Therefore this action was dismissed in the action alternatives because it would have greater impacts and would not solve the problem at this location.

#### *Remove Trees Near Wilson Creek to Improve Sight Distance*

Removal of the trees would affect the riparian buffer between the road and the creek, causing additional adverse impacts to this riparian wetland. There has also been no indication of a problem regarding limited sight distance or safety (as documented by accident records) at this location.

#### *Reroute the Stehekin Valley Road around Private Property Near the Beginning of the Reroute*

This reroute underwent preliminary design by FHWA following the public comment period on the DEIS. Because it would have greater impacts and higher cost than the reroute evaluated in the DEIS and does not achieve an objective of distancing the proposed realignment from private property, it was eventually dismissed.

### *Pave the Stehekin Valley Road Shoulders*

Surfacing the road shoulders would require additional disturbance beyond the edge of the road, including additional tree removal and would increase the overall cost of the proposed project, while not providing substantial additional benefits. Therefore this action was dismissed in favor of surfacing the existing top-width of the Stehekin Valley Road which would minimally disturb adjacent vegetation.

### *Construct a Culvert, rather than a Low-Water Crossing at Milepost 9.2*

Because there is a great deal of sand and gravel transported by this stream, a culvert in this location would be easily plugged and would not improve drainage, therefore not resolving the need for improving drainage in this location. As a result, this action was dismissed.

### *Retain the Stehekin Valley Road in McGregor Meadows and/or Add a Road Reroute Later and Other Selected Actions*

Not raising the road grade through McGregor Meadows (Alternatives 1 and 4) or not rerouting the road, as in Alternatives 2, 3 and 5, would not meet the purpose and need because Lake Chelan NRA would be unable to maintain access to and within the lower Stehekin Valley. Because of the increased magnitude and frequency of flooding and damage to the parts of the Stehekin Valley Road in the floodplain and channel migration zone, access would eventually be lost. Retaining the road in McGregor Meadows was also dismissed because it would have greater impacts than other alternatives. Access to the upper Stehekin Valley Road would be lost temporarily for two years or longer while the park awaited funding of a reroute in the event of a future major erosion event. A temporary access road if constructed to pass through this area would cause more impacts to the Stehekin River and its associated wetlands and floodplain. In addition, if a reroute was later considered, a great deal of additional fill would need to be imported because it would not be available from other parts of the proposed alternatives. (Note: Among the other selected actions were realignment of the road 50 feet from the current road edge.)

### *Construct half of the Reroute, depending on which part of the McGregor Meadows section of the Stehekin Valley Road would be most likely to be Damaged in Future Flooding*

This alternative was considered based on estimated costs and analysis of where it would be most likely that the Stehekin Valley Road would be lost first due to future flooding. Because it is not possible to ascertain with certainty where the road could be most affected first and because this alternative would require additional importation of materials, it would not meet the purpose and need because it would require either a two year closure of the Stehekin Valley Road and/or a temporary reroute (causing more impacts). Therefore, it was determined infeasible and was dismissed from additional consideration.

### *Construct the Proposed Rainbow Falls Camp at the Historic Location of this Camp*

This historic campsite location was dismissed in the SRCIP because it is on the opposite side of the creek. Constructing a new camp on the east side of the creek would require a toilet and additional impacts. Keeping the camp on the west side of the creek as described in the DEIS would concentrate the impact to the area near the current parking lot and along a former roadway and would take advantage of existing infrastructure.

### *Relocate the Shooting Range in Alternative 5*

Based on public comments, relocating the shooting range was considered as part of the modifications to Alternative 2 for Alternative 5. Although an area was initially identified near Milepost 7.5, this idea was eventually dismissed based on continuing conflicts with NPS policy (because of the potential for lead contamination and because the reestablishment of shooting ranges is discouraged in parks) and because it would have greater impacts than in Alternative 2.

## E. MITIGATION MEASURES

See individual environmental impact analysis sections under Chapter IV: *Environmental Consequences* and Appendix 6: *Summary of Mitigation Measures*.

## F. ENVIRONMENTALLY PREFERABLE ALTERNATIVE

Implementing regulations for NEPA promulgated by the CEQ require that agencies identify "the alternative or alternatives which were considered to be environmentally preferable." "Environmentally preferable" is defined as the alternative that will promote the national environmental policy as expressed in Section 101 of NEPA, including:

- Fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations;
- Ensuring for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- Attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- Preserving important historic, cultural and natural aspects of our national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice;
- Achieving a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
- Enhancing the quality of renewable resources and approaching the maximum attainable recycling of depletable resources. (NEPA Section 101(b))

The environmentally preferable alternative is "the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources (46 FR 18026 - 18038). According to Director's Order 12, through identification of the environmentally preferable alternative, the NPS and the public are faced with determining the relative merits of the choices before them as represented among the alternatives and must clearly state through the decision-making process what values and policies were used in reaching a decision. As shown through the analysis below, the environmentally preferable alternative is Alternative 2, as was described in the DEIS.

1. **Fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations:** All Alternatives (1 - 5) would fulfill this CEQ criterion because the NPS is required by law and policy to minimize its impacts on the environment and to preserve natural, cultural, and other park resources without impairment in its management of national parks, including Lake Chelan NRA. Of the alternatives, Alternatives 1 and 4 would have the fewest new impacts on Lake Chelan NRA resources, while Alternatives 2, 3 and 5 would have the fewest impacts on the floodplain / channel migration zone of the Stehekin River. Alternatives 2, 3 and 5 also represent more sustainable, long-term solutions to current issues. Alternatives 2 - 5 would improve existing adverse impacts to water resources by removing development from both the floodplain and channel migration zone of the Stehekin River. Because Alternatives 2, 3 and 5 would employ fewer erosion protection structures and would reroute the road away from the floodplain / channel migration zone of the Stehekin River instead of continuing to add structures to harden the banks of the river, Alternatives 2 and 3 and 5 would best meet the first CEQ criterion.

2. **Ensuring for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings:** Alternatives 2 - 5 would meet this CEQ criterion by minimizing impacts through implementation of mitigation measures, including impact avoidance and best management practices. Alternatives 2, 3 and 5 would improve safety for employees, residents, and visitors to Lake Chelan NRA by relocating part of the road out of the floodplain / channel migration zone. Alternative 3, however, would have a shorter reroute and would remain partially within the floodplain / channel migration zone. Alternative 5 would include construction of the Reroute Access Connector across a wetland and the channel migration zone. Therefore, Alternative 2 would best meet this criterion.

3. **Attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences:** Beneficial uses in all alternatives would include ongoing residential use, resource preservation, and recreational uses of the lower Stehekin Valley. Recreational uses would be broadest in Alternative 4, while protection of the Stehekin River floodplain / channel migration zone would be greatest in Alternatives 2 and 5. Alternatives 2 - 5 would also increase the diversity of recreational experiences through new campgrounds (Alternatives 2 - 5) and a new river access point (Alternatives 2 and 5). The fewest new short-term impacts to existing resources would occur in Alternative 1. Safety improvements associated with the Stehekin Valley Road would occur in all alternatives. As noted above, Alternatives 2, 3 and 5 would also have the greatest safety improvements from relocation of part of the Stehekin Valley Road out of floodplain. Overall, Alternatives 2 and 5 would best meet this criterion.

4. **Preserving important historic, cultural, and natural aspects of our national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice:** Although all alternatives would preserve historic and cultural resources, enhancement through interpretation would occur in Alternatives 2 - 5, which would best meet this criterion. None of the alternatives would affect portions of the Old Wagon Road or other resources eligible for the National Register.

5. **Achieving a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities:** The LPP revision implemented

in Alternatives 2 - 4 would meet this CEQ criterion, because it would reduce the number of acres available for land exchanges and remove some sensitive lands still available in Alternative 1. The LPP revision in Alternative 5 would also have similar results. Among Alternatives 2 - 5, Alternatives 2, 3 and 5 would best meet this criterion because their intent is to remove development that is adversely affecting or could adversely affect the Stehekin River and its floodplain, but also its channel migration zone. They also would remove a portion of the Stehekin Valley Road from within the floodplain / channel migration zone to higher ground. Private developments now threatened by the changing flood regime on the Stehekin River would be identified as high priority for exchange or acquisition, thereby allowing affected property owners a means to avoid future flooding impacts if they so choose. Although Alternative 5 would also provide long-term access to the McGregor Meadows area, it would do so by affecting a wetland and a small part of the channel migration zone, therefore Alternative 2 would best meet this criterion.

6. **Enhancing the quality of renewable resources and approaching the maximum attainable recycling of depletable resources:** All Alternatives (1 - 5) would best meet this CEQ criterion because of the removal of the current maintenance facility and NPS housing from the floodplain and construction of new maintenance facility and housing on disturbed lands near the Stehekin Airstrip. These facilities would meet standards for LEED certification. Of these alternatives, Alternatives 2, 3 and 5 would offer a slight advantage for this criterion because they would employ the least amount of imported resources, relying instead on the reuse of materials from within the proposed reroute areas.

Alternative 2 best meets each of the criteria. Although Alternatives 2, 3 and 5 each meet three or more of the criteria, only Alternative 2 meets all of them, therefore Alternative 2 is the environmentally preferable alternative.

Photo 14 – Stehekin River at Buckner Orchard (the photo shows part of the buffer restoration site).

# G. CONSISTENCY OF ALTERNATIVES WITH PURPOSE AND NEED

As explained in Chapter 1, the primary purposes of this draft Stehekin River Corridor Implementation Plan / environmental impact statement (SRCIP/EIS) are to:

- Sustainably operate and maintain NPS administrative facilities, public access (via roads and trails), and campgrounds;
- Protect water quality, scenic values, habitat, and natural processes of the Stehekin River; and
- Partner with the Stehekin Community to provide services, facilities and experiences for visitors.

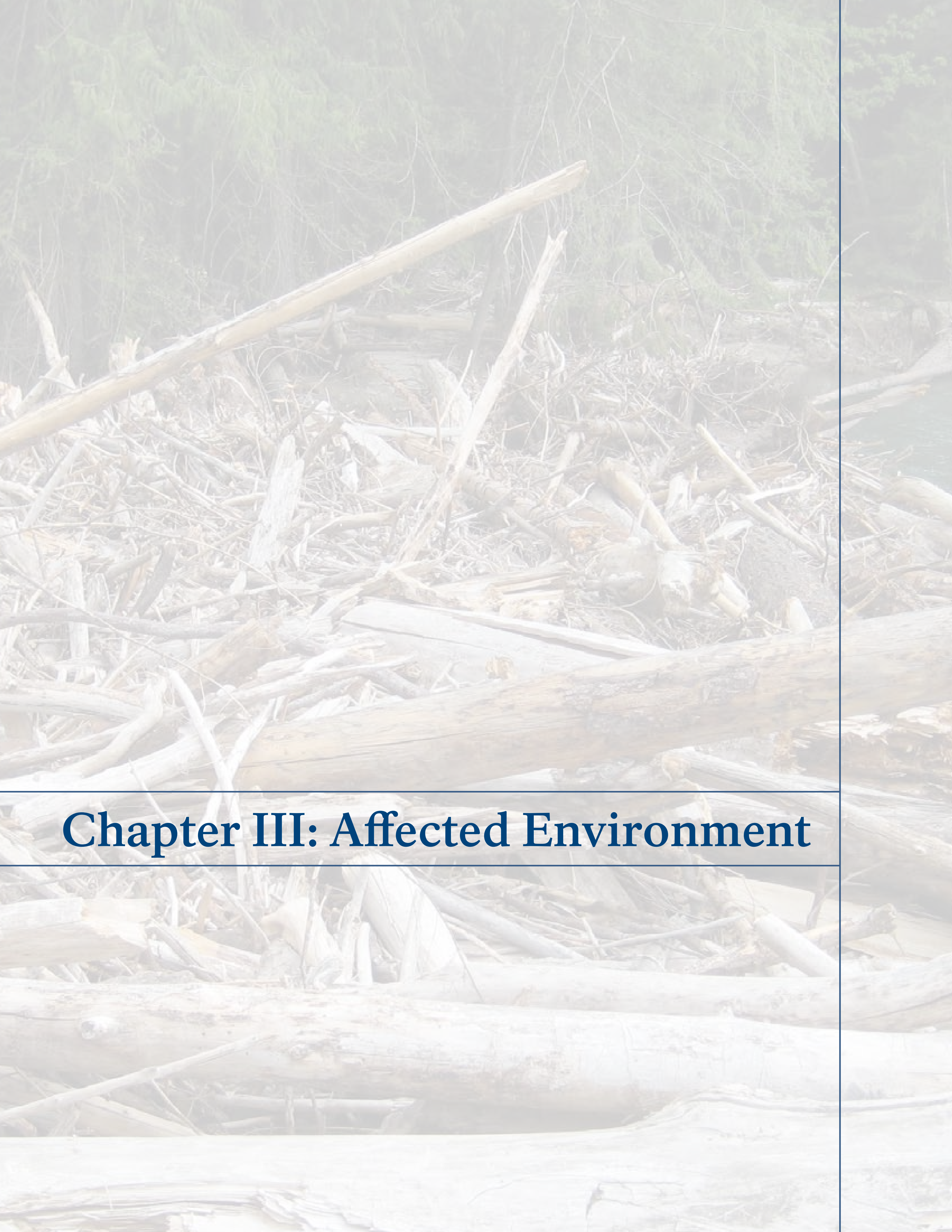
These purposes are consistent with the Lake Chelan NRA GMP (NPS LACH 1995).

All action alternatives (2 - 5) would improve the sustainability of the Stehekin Valley Road and would relocate administrative facilities currently in the floodplain / channel migration zone. Alternatives 2 and 5, however, would best meet this purpose because they would move most of the Stehekin Valley Road out of the floodplain / channel migration zone, therefore resulting in more sustainable NPS administrative facilities and public access.

Because Alternatives 2 and 5 would relocate a greater portion of the Stehekin Valley Road out of the floodplain / channel migration zone and would locate fewer erosion protection measures within the Stehekin River, they would best protect water quality and the natural processes of the Stehekin River. Alternatives 1 and 4 would protect the greatest degree of forested habitat, while Alternatives 2 and 5 would enhance the greatest degree of riparian habitat. Compared to Alternative 1, Alternatives 2 - 5 would reduce the amount of land that could be exchanged and would focus remaining land protection on the sites most at risk.

Maintaining the Stehekin Valley Road for vehicle access up to High Bridge would continue to enable people to access the entire length of Lake Chelan NRA and to reach North Cascades National Park. Loss or closure of the road at some mid-point could result in reduced access to recreational opportunities, including hiking, camping, picnicking, river rafting and wildlife viewing. Loss of access at some mid-point, depending on where it occurred, could also reduce vehicle access to private property along the road corridor. The Lake Chelan GMP calls for retaining vehicle access to High Bridge to meet these needs.

The revised LPP would meet the needs of the NPS to protect the values of Lake Chelan NRA and could also help the community by providing sustainable sites for future development outside the Stehekin River channel migration zone.



# Chapter III: Affected Environment

**Logjam at McGregor Meadows. Combined with another logjam on the other side of the river, this feature covers nearly five acres, contains more than 3,000 logs, and is 20 feet deep in places.**

# CHAPTER III: AFFECTED ENVIRONMENT

This chapter provides information about the Lake Chelan NRA environment, focusing primarily on those resources that could be affected by the actions in the alternatives. As the largest tributary to Lake Chelan (Figure III-1: *Lake Chelan Basin*), the Stehekin watershed has a major influence on water quality. The primary influences on Lake Chelan water quality, however, are likely from the superfund site at Holden, in the Railroad Creek Valley, and pesticides used on orchards, vineyards, and lawns at the south end of the lake. The Stehekin watershed is primarily located within designated wilderness and its main influences on Lake Chelan are from the volume of inflow and the contribution of fine-grained sediment.

Among the resources included are land use, air quality, geologic hazards, soils, water resources (including hydrology and streamflow, water quality, floodplains, and wetlands), vegetation, wildlife, special status wildlife, archeological resources, cultural landscapes, visitor experience (including access and transportation, interpretation and education, visitor use opportunities, safety, and scenic resources), Wild and Scenic Rivers, park operations, socioeconomics, hazardous materials, and the following three topics required in environmental impact statements: unavoidable adverse impacts, relationship between short-term use of the environment and maintenance and enhancement of long-term productivity, and irretrievable and irreversible commitments of resources.

## A. INTRODUCTION

According to the Council on Environmental Quality (40 CFR, Sec. 1502.15), "Affected Environment" should describe only those resources that could be affected by implementation of the alternatives. In response to public comments however, the NPS has included additional information on a broader range of socioeconomic resources in Lake Chelan NRA in this FEIS than would be affected by the actions in the alternatives. Impacts to those aspects of socioeconomics that could be affected are described in the next chapter.

The resource descriptions below serve as a baseline from which to compare the environmental effects, or impacts, of the management actions considered in this plan.

## B. POTENTIALLY AFFECTED RESOURCES

### 1. Land Use

The Stehekin Community is characterized by dispersed, low-density development, with higher-density clusters located at McGregor Meadows, along the upper Company Creek Road, and around the head of Lake Chelan. Development generally does not line the Stehekin Valley Road, rather it extends back from it, away from most areas seen by Lake Chelan NRA visitors (NPS LACH 1995c:7). Of the federal lands, 50 acres were identified as available for exchange based on the 1995 Land Protection Plan (LPP).

**Figure III-1: Lake Chelan Basin**

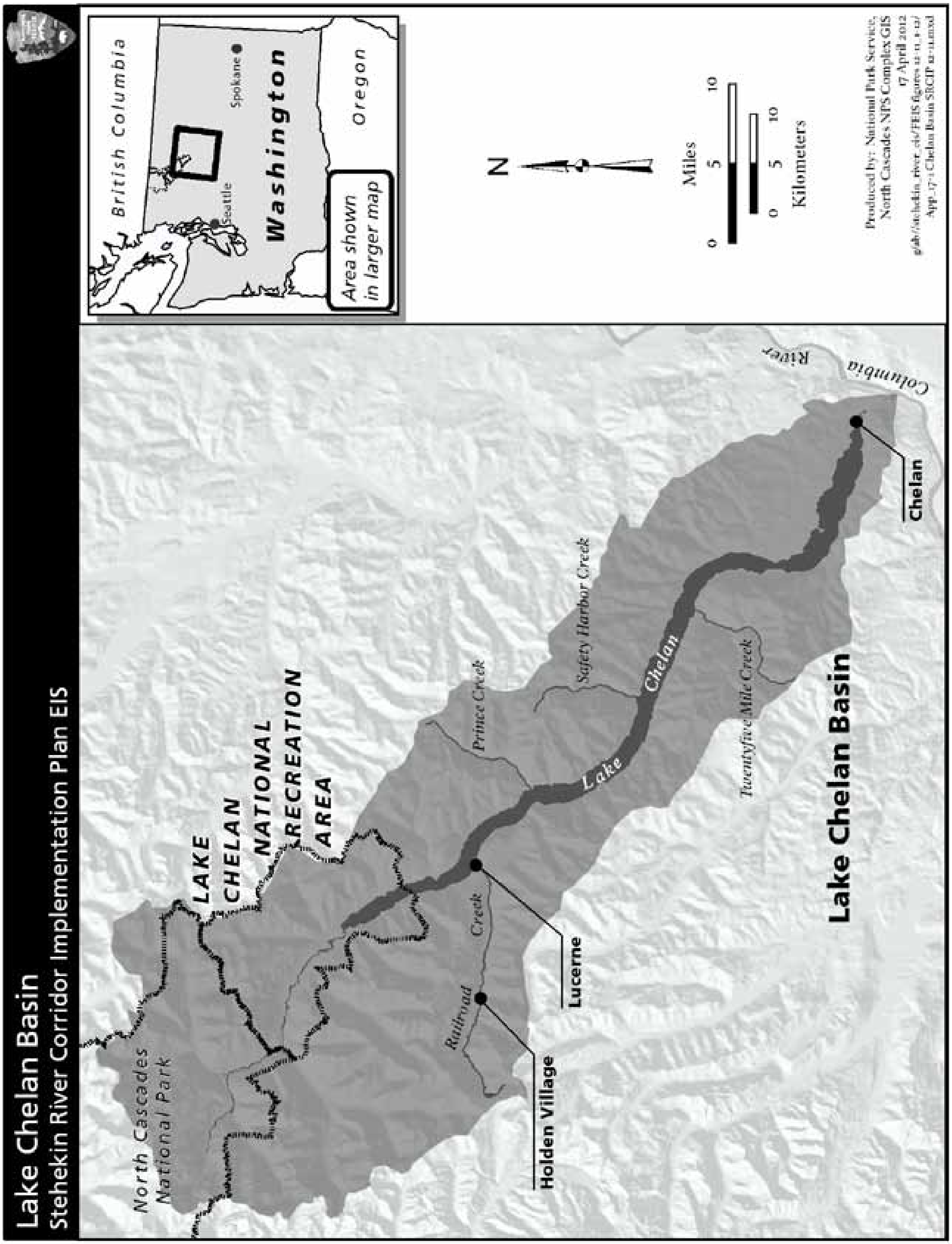


Table III-1: *Land Ownership Changes in Lake Chelan NRA 1995 - 2010* compares land ownership in Lake Chelan NRA between 1995 (when the LPP was written) and in 2008 upon embarking on this plan.

**Table III-1: Land Ownership Changes in Lake Chelan NRA 1995 - 2011**

| Owner | 1995 Acres | 2010 Acres |
|---|---|---|
| Federal (NPS and BLM) | 59,307.22 | 59,337.01 |
| State (submerged lands) | 2,020.00 | 1,994.43 |
| Chelan County Public Utility District (Chelan PUD) #1 | 249.43 | 198.94 |
| Stehekin School District | 3.20 | 3.20 |
| Private | 459.28 | 416.80 |
| *Note: The above numbers are the same as those contained in the 1995 and revised 2010 draft LPP.* | | |

Land use within the Stehekin Valley includes undeveloped federal and private land, forest land, agriculture land, rural residential private land, and some densely developed federal and private land. Other land uses include maintenance of the Buckner Homestead hayfield and pasture, some irrigated gardens, pastures and corrals, lands used for recreation (camping and hiking), and (as noted above), school district and Chelan PUD lands.

Human disturbance in the Stehekin Valley has been extensive. It includes selective and clear-cut logging, and clearing for development and agriculture, including NPS administrative and private residential development. Recreation facilities include trails, bridges, camps, and a visitor center. Sixteen gravel pits were identified in the General Management Plan (GMP), but only the Company Creek Pit is active today. There are two main roads, with the Stehekin Valley Road extending 12 miles from Lake Chelan. The Company Creek Road extends from Harlequin Bridge for three miles up the west side of the valley. Lake Chelan floods the lower mile of the valley. The Silver Bay development is built on fill along the Stehekin River and Lake Chelan.

An estimated 283 acres of land have been affected by development. This represents about 11.1 percent of the 2,543 acres in the lower valley not in wilderness (at the 1,640-foot contour). Approximately 188 acres of the developed land (66 percent) is within the riparian zone (NPS LACH 1995a:184 and 187). An additional 1,400 acres of the valley have been impacted by the removal of snags and downed logs for firewood, for a total of 1,683 acres directly affected by human activities. If areas with past logging are added to this disturbance, approximately 2,253 acres, or 88 percent, of the Stehekin Valley has been directly or indirectly affected by human activities (NPS LACH 1995a:187). Logged areas are slowly recovering and most are now second-growth forest.

## Stehekin River Floodplain Development

Because development is generally limited to the relatively flat floor of the valley, much of it has occurred within the Stehekin River floodplain. Yet, this floodplain comprises only two percent of the watershed. Approximately half of the private land within the Stehekin Valley lies within the channel migration zone (CMZ), the area within which the Stehekin River has historically migrated over the past 1,000 years. Numerous private homes and some administrative facilities are located within the 100-year floodplain, which is within the channel migration zone. (The 100-year floodplain and CMZ are compared in Figure III-4 on page 199.)

The other half of the privately owned land within Stehekin likes outside the channel migration zone and is considered safer from modern and future flooding or erosion. Most of these sites are located on relict river terraces, moraines or higher parts of alluvial fans. Elsewhere, various riverine processes such as bank erosion, sediment deposition, periodic channel shifts, and swift water during floods will continue to cause the river to change shape and location as it flows toward Lake Chelan.

The Stehekin Valley Road traverses the channel migration zone in numerous locations, including at Mileposts 7.0 and 8.0 and within McGregor Meadows (Figure i-5: *McGregor Meadows Reroute Map*). For approximately three miles of its 12-mile length through the lower Stehekin Valley, the Stehekin Valley Road is directly adjacent to the river or at a low elevation within its 100-year floodplain.

Stehekin Valley locations available for development are limited due to the steep valley walls and relatively confined nature of the valley. Among the best locations for development, to avoid recurrent geologic hazards, are former river terraces and stable alluvial fans. Ongoing threats to development include relatively rapid bank erosion, sediment deposition, periodic channel shifts, and swift water. Floodplain conditions are summarized in Appendix 17: *Draft Wetlands and Floodplains Statement of Findings*, but along the road at McGregor Meadows and upper Company Creek, flood events that occur every few years can make the road impassible (see Appendix 17). Due to the recent changes in the floodplain and river channel processes, floods occur more frequently at lower discharges at McGregor Meadows (Riedel 2004).

## 2. Air Quality

Under the Clean Air Act, Lake Chelan NRA is a class II area, while surrounding North Cascades National Park and Glacier Peak Wilderness are class I areas. Although valley air quality is generally good, it is affected by pollutant discharges within and outside the Stehekin Valley. The area is fewer than 90 miles from the Seattle, Washington and Vancouver, British Columbia metropolitan areas. Prevailing wind patterns can bring pollutants such as ozone, sulfur dioxide, nitrogen oxides, mercury, and other metals as well as particulates into the area, where they are trapped by mountain valleys and concentrated in snowfall at high elevations. Pollution sources west of the watershed include automobiles, refineries, smelters, incinerators, and power plants. These pollutants can cause impacts such as reduced visibility and acid rain (which may affect forest productivity, degrade surface water quality, affect amphibian reproduction, and cause damage to metal and painted surfaces). Recent analysis of snowpack indicates that pesticides from orchards in the Methow and Columbia valleys are being transported to the upper reaches of the Stehekin River watershed. Recent research by the U.S. Geological Survey (USGS) has documented elevated levels of mercury and organochlorine compounds in fish tissues from the park's high-elevation lakes. Additional research is planned to determine the source of these contaminants (NPS 2009).

Pollutants from within the Stehekin Valley include negligible to minor emissions from auto exhaust, moderate localized outputs from diesel-powered generators that back-up the valley's small hydroelectric plant, particulate emissions related to travel by residents and visitors on numerous unpaved roads, and emissions from wood and pellet heating devices. Intermittent wildfires and prescribed burns and dust from the exposed mudflats at the head of Lake Chelan in spring can also degrade air quality. Dust from the unpaved Stehekin Valley Road is also a local issue during the summer.

North Cascades NPS Complex is within a National Ambient Air Quality Standards (NAAQS) attainment zone for all ambient air quality standards. Recent data show air quality in the vicinity of monitoring stations to be below the NAAQS for particulate matter, nitrogen dioxide, sulfur dioxide, nitrates, sulfates, and ozone. The NAAQS describe thresholds for monitored air chemistry concentrations of six "criteria pollutants:" nitrogen dioxide ($NO_2$); sulfur dioxide ($SO_2$); carbon monoxide (CO); lead (Pb); ozone ($O_3$); and particulate matter ($PM_{10}$ and $PM_{2.5}$). These are intended to protect public and resource health. Areas in the U.S. that meet these thresholds are attainment areas. Areas that do not meet these thresholds are nonattainment areas and areas that have previously been nonattainment areas that now meet the standards are maintenance areas. Increases in pollution that would cause violation of the NAAQS are not allowed in class I or class II areas.

In the Complex, monitoring stations are located at Ross Dam (visibility), Marblemount Ranger Station (acid deposition), and Newhalem Visitor Center (digital web camera). Air pollution in and near parks may affect visibility ($NO_x$, $SO_x$ and particulates); human health (hydrocarbons, ozone precursors, $NO_x$, $SO_x$, particulates and air toxics); and ecosystems (ozone, acidic deposition of nitrogen and sulfur, nitrogen nutrient enrichment and air toxics) (NPS 2010). The documented effects on resources from poor air quality include impairment of visibility, injury and reduced growth of vegetation, and acidification and fertilization of soils and surface waters (USFS, USFWS, NPS 2010).

Air quality is very good in Lake Chelan NRA, although it is periodically affected by the above-named sources of pollutants. Impacts to air quality, including smoke from nearby fires, usually dissipates rapidly with wind from the west, but lingers if winds are from the east, if there is a temperature inversion, or if there is no wind. Air quality-related values include human health, visitor enjoyment, scenic vistas, and the preservation of natural systems and cultural resources.

Deterioration of pristine air quality in the Complex is likely due to prevailing westerly winds that carry vehicle emissions and industrial and large urban area pollutants from Puget Lowland, and marine pollutants from the Puget Sound. Recent research also indicates that polluted air from Asia is transported across the Pacific Ocean and deposited in the Cascade Mountains, including within the Stehekin Watershed. Currently, only visibility and acid rain are being monitored. Visibility cameras have recorded the presence of airborne particulate matter. A webcam view of the Picket Range from the North Cascades Visitor Center gives an hourly (real-time) perspective on visibility.

## 3. Geology

The northern portion of the Cascade Range is one of the youngest mountain ranges in the world, with dramatic geologic events continuing to occur, including eruption of volcanoes, earthquakes, and erosion by glaciers, rivers, and gravity. Approximately 316 glaciers cover about 30 square miles in North Cascades NPS Complex.

The Stehekin Valley is located in the Chelan Mountains terrane, an area bounded by faults that has a distinct bedrock geology and history compared to adjacent areas. This terrane contains rocks that originated both from the sea-floor and from volcanic activity. Through intense heat and pressure (metamorphosis) these former oceanic rocks have recrystallized into Skagit Gneiss, which is the primary bedrock in Lake Chelan NRA. Sedimentary and volcanic rocks were also metamorphosed into mica schists. In many places these older metamorphic rocks were intruded by younger granite.

The Stehekin Valley is carved out of the Skagit Gneiss complex, known as the crystalline core of the North Cascades. These quartz- and feldspar-rich rock types provide abundant amounts of sand and gravel to the Stehekin River system. Relief within the watershed varies from 9,511 feet amsl at Bonanza Peak to a low of 350 feet below mean sea level in Lake Chelan, making the valley one of the deepest gorges in North America.

Although the valley walls of the lower Stehekin were over-steepened by glaciers, the competency of Skagit Gneiss has allowed the remarkable development of the Lake Chelan basin. Thirteen large landslides have been mapped by the NPS in the entire Stehekin watershed within North Cascades National Park and Lake Chelan NRA. Eight of these landslides have delivered sediment directly to major tributaries of the Stehekin River. The Agnes Creek watershed, however, has not been examined for mass movements to date.

The trend of the Stehekin River follows the northwest-southeast alignment of most major faults and valleys in the region. Geologists do not think the Stehekin River exploited this structural grain, rather it is thought that the Stehekin River was superimposed on the crystalline core of the range as the North Cascades were uplifted.

The Stehekin River Valley is a classic example of a U-shaped glacial trough, formed during multiple ice ages by erosion from enlarged local glaciers and the colossal Cordilleran Ice Sheet. It is deeply incised into resistant bedrock, with steep valley walls that carry snow avalanches and debris torrents. The valley floor is broad and flat, and reaches 1.8 miles in width at the head of Lake Chelan. The summit of McGregor Mountain, at 8,122 feet above mean sea level (amsl), stands nearly 7,000 feet above the lower Stehekin Valley, east of High Bridge (NPS LACH 2005b).

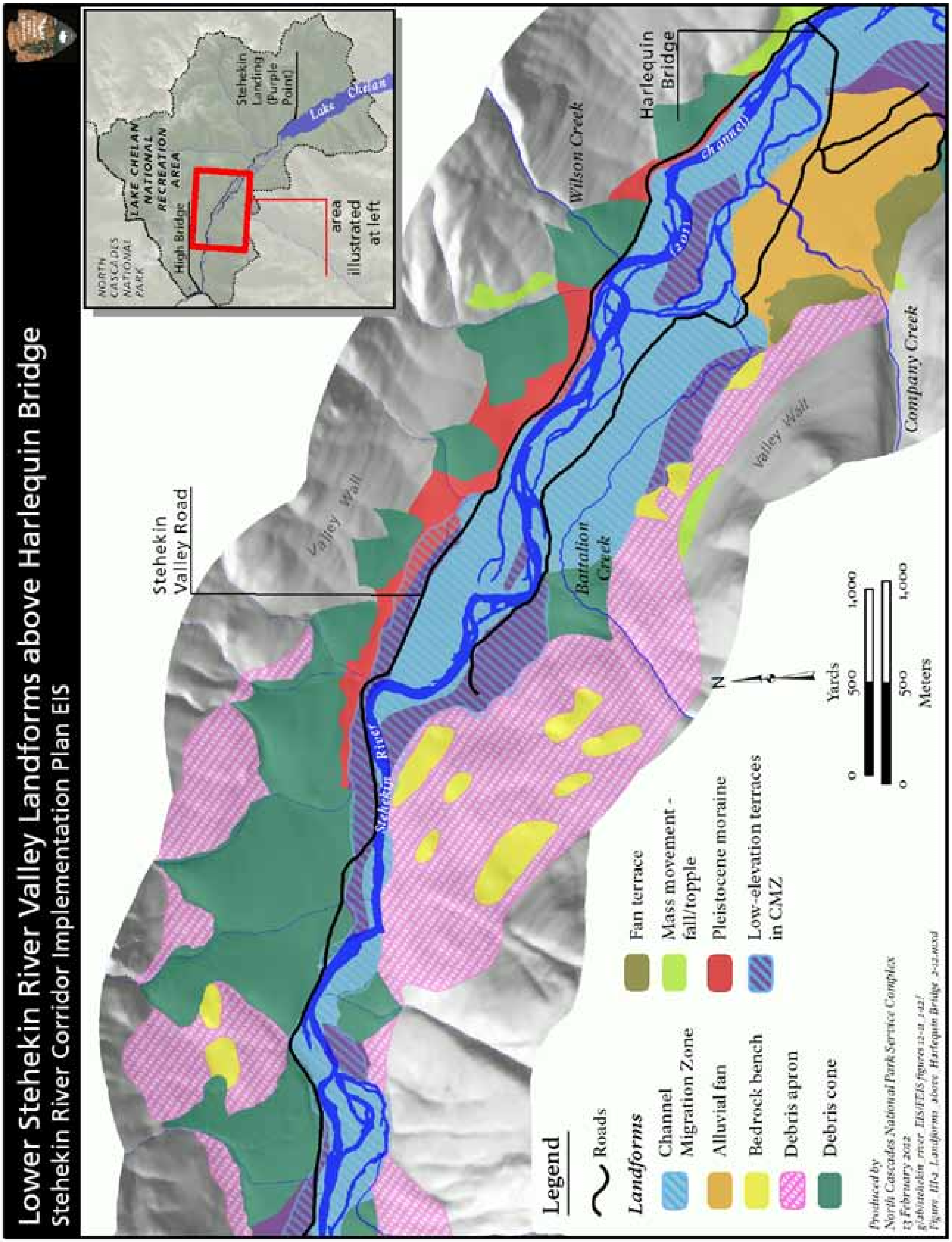
Below High Bridge, the Stehekin River and Agnes Creek emerge from deep box canyons into the broad lower Stehekin Valley (Figure III-1: *Lake Chelan Basin* and Figure III-2: *Lower Stehekin Valley Landforms above Harlequin Bridge*). On the southwest side of the valley, glaciers from the last ice age left a long, lateral moraine 14,000 years ago that can be traced from the Stehekin Valley Ranch to the Orchard (Figure III-2).

The Stehekin River channel in the lower valley above the orchard is incised 10 - 15 feet within sand and gravel terraces. Extensive alluvial fans deposited by its major tributaries, Company, Boulder, and Rainbow Creeks, help to define the area within which the Stehekin River has meandered. The alluvial fans themselves have older upper terrace surfaces that have presumably not been affected by flooding for a very long time, and represent appropriate sites for development to avoid flooding from the river or its tributaries.

The fan terraces grade to elevations more than 20 feet above the modern floodplain, when the level of Lake Chelan was higher at the end of the last ice age. Thus, the base level for the lower Stehekin Valley decreased until 1902, when Chelan PUD raised the level of the lake 21 feet with a hydroelectric dam. The backwater effect of the lake is discussed below. The base level of the river above Buckner Homestead hayfield and pasture may be bedrock controlled. The river channel at this site is currently superimposed across a bedrock valley spur known as Buckner Rock (Figure III-3: *Lower Stehekin Valley Landforms below Harlequin Bridge*).

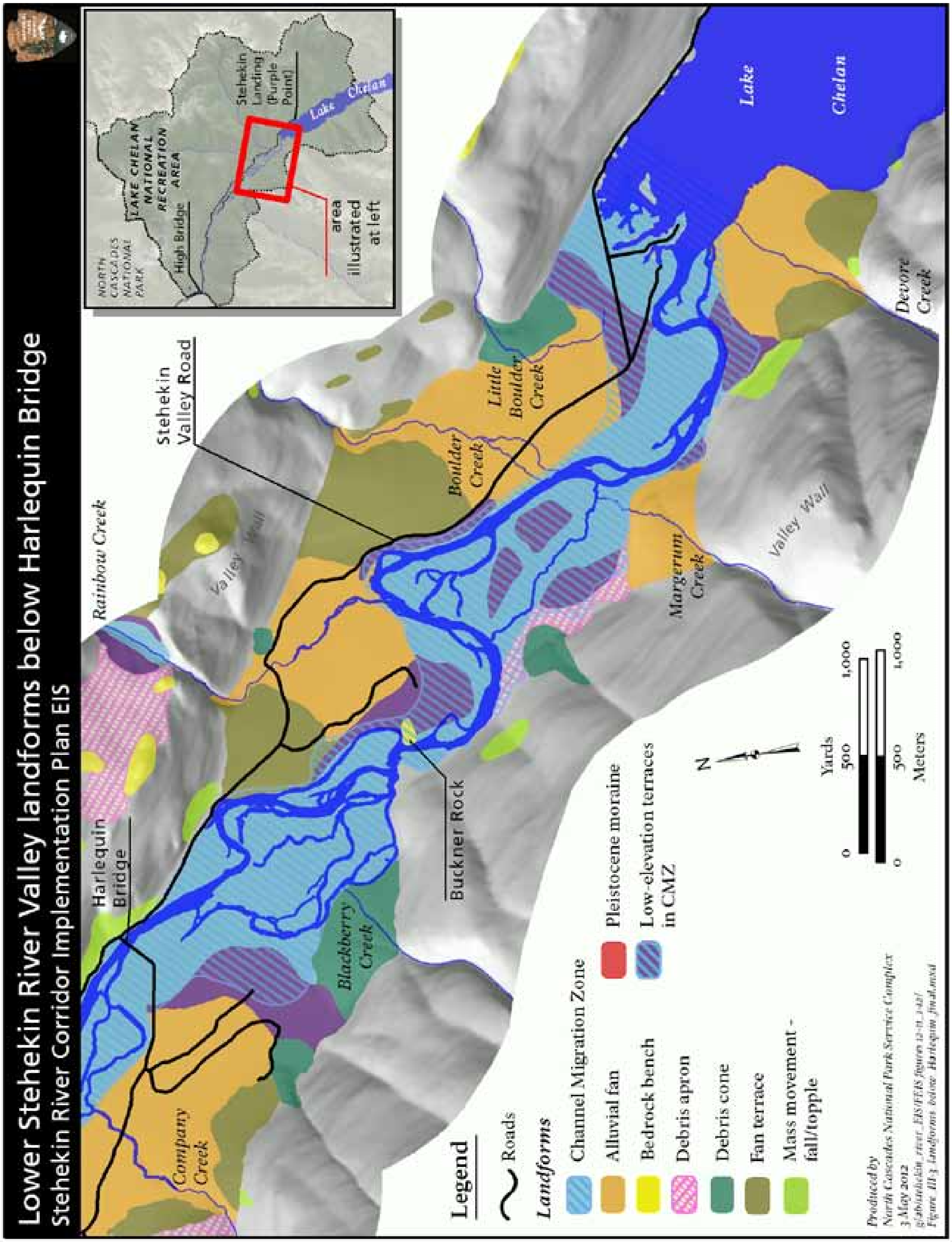
At the end of the last ice age, about 10,000 years ago, Lake Chelan covered the lower valley to Buckner Orchard and had a surface elevation near 1,240 feet. Erosion at the south end of the

## Figure III-2: Lower Stehekin Valley Landforms above Harlequin Bridge




*(Note the orange colored alluvial fans built by tributary streams and purple colored terraces above the floodplain.)*

**Figure III-3: Lower Stehekin Valley Landforms below Harlequin Bridge**



lake at the outlet lowered the lake surface to about 1,080 feet by 1900 A.D.. Below the orchard, the lower valley is underlain by a thick silt and clay layer that represents the former bed of Lake Chelan. Evidence uncovered by the NPS indicates that the Stehekin River met Lake Chelan just below Buckner Homestead hayfield and pasture. Private cabins sit on a layer of thick gravel over fine sand and silt that was the river delta at that time. Downvalley of the delta deposit, the silt and clay from deeper parts of the former lake bed are exposed near the surface in low-lying areas near the river, and at depths of 25 - 30 feet, as documented in well logs from sites on the Boulder Creek and Rainbow Creek fans. The presence of this layer probably limits the stream gradient in the lower valley.

There is a pronounced asymmetry in the geomorphology of the lower Stehekin Valley due to the extreme northeast-southwest faces of the valley walls (Figure III-3: *Lower Stehekin Valley Landforms below Harlequin Bridge*). The hot, dry north side of the valley is characterized by steep streams that are known to carry debris flows to the Stehekin Valley floor. These small, steep streams are activated by isolated summer thunderstorms. In contrast, forest cover is thicker on the northeast facing side of the valley, and runoff is generally less flashy.

While the North Cascades mountains continue to rise, earthquakes in the area are infrequent. The largest event on record was the 1872 earthquake. Although the epicenter of this event is unknown, it is believed to have occurred somewhere near Chelan (Baukun et al. 2002). Smaller quakes occur on the order of one every few decades, with the most recent an earthquake in January 2007 in the Bridge Creek Watershed.

## 4. Soils

Major soil orders in the valley include Entisols, Inceptisols, Spodosols, and Andisols. Soils in the Stehekin Valley are generally fairly young, shallow, and coarse grained, having developed in sand and gravel deposited by streams, glaciers, and gravity. They also lack cohesion, are resistant to compaction, and, if sandy, are prone to rapid rates of erosion. Entisols (young, poorly developed soils) may support plant growth, but have little horizon development. Inceptisols have some subsoil development but are generally noncohesive (loose, with little clay), subject to rapid rates of erosion, and low in organic matter. Spodosols occur on older stable landforms at higher elevations. Andisols form in deposits with high amounts of volcanic ash. They are fine sand in texture and prone to rapid erosion (NPS LACH 2005b).

The steep valley walls are covered with varying amounts of glacial sediment, talus, bare rock, colluvial (slope) deposits, and volcanic ash. Most soils on steeper slopes above the valley floor are Entisols and Andisols, although some flat bedrock benches can have soil crusts. The Stehekin River is largely responsible for the distribution of soil types on the valley floor. The movement of the river and its tributaries erodes and deposits sediment, creating floodplains, alluvial fans, and terraces. The age, texture, and topography of these features characterize the type of soil development. Most soils in the floodplain are Entisols and Inceptisols, but their sensitivity to disturbance varies widely.

Recent soil surveys completed for the Stehekin Valley have identified 22 distinct soil series. Specific properties of these soils will be published by the Natural Resource Conservation Service in 2012.

## 5. Geologic Hazards

Geologic hazards present in the Stehekin Valley include those associated with flooding along the Stehekin River and debris torrents on tributary streams. When these streams reach the flat floor of Stehekin Valley, they deposit "debris cones." Alluvial fans form where larger tributaries meet the Stehekin, but these landforms are not as hazardous as debris cones. In general, debris cones can be distinguished by having slopes greater than ten degrees, while alluvial fans have slopes less than five degrees. Steep slopes contribute to snow avalanche and rockfall hazards. Instability of unconsolidated glacial and valley wall deposits occurs where they are undercut by the river.

Debris cones form over time by the rapid mass movement of boulders, mud, and trees during heavy rain, and especially where landslides or fire have removed vegetation in the upper portion of a steep stream channel. Wilson Creek is an example of an active debris torrent system, where debris has been recently transported down a steep, straight valley and a deep canyon, to the valley bottom. In contrast, the larger Boulder, Rainbow, and Company creeks have formed alluvial fan deposits where they reach the flat valley floor. Several factors influence the activity of debris torrents, including slope, faults, or bedrock weakness and vegetation disturbance.

Similar to river channels, alluvial fans have a migration zone, where the stream is most active. The unstable areas of the major alluvial fans (Boulder, Company, and Rainbow Creeks) have been identified. Older portions of these fans are more stable than the fan migration zone and have been identified in the SRCIP action alternatives and revised LPP as suitable for relocation of some development out of the floodplain.

Snow avalanches and rock falls are common along the steep walls of the Stehekin Valley and off the unstable edges of river or glacial terraces. Talus slopes, such as the one near Harlequin Bridge, are actively accumulating rocks from cliffs above.

Potential geologic hazards within the Stehekin Valley exist at the following locations within the proposed project area:

- Alongside steep valley slopes on the edge of the moraine at McGregor Meadows;
- Rock falls at Milepost 8.0, where the Stehekin Valley Road cuts across a glacial moraine studded with boulders;
- Rock fall hazards off the steep valley side walls in Alternatives 2, 3 and 5 along the reroute, at Frog Island, and along the lakeshore;
- Debris cones along the reroute proposed in Alternatives 2, 3 and 5, at Wilson Creek and at the Stehekin Landing; and
- Existing portions of the Stehekin Valley Road and Company Creek Road along the main channel and in the lowest parts of the floodplain.

## 6. Water Resources

(See also: Chapter I: *Purpose of and Need for Management Action*, "Background" section.)

The Stehekin River is the focal point of Lake Chelan NRA. The river drains 220,000 acres (344 square miles) of mostly public and undeveloped land in the rugged Glacier Peak Wilderness

Area, Lake Chelan NRA, and North Cascades National Park. Most of the watershed is comprised of designated wilderness. Major tributaries to the Stehekin include Bridge Creek, Agnes Creek, Company Creek, Rainbow Creek, and Boulder Creek (Riedel 2007) (Figure III-1: *Stehekin River Watershed*).

The Stehekin River's headwaters rise from glaciers located along the Pacific Crest of the Cascade Range. Approximately 103 small glaciers cover about three percent of the watershed, but provide as much as 15 percent of runoff during the dry summer months, or 21 billion gallons (Riedel and Larrabee 2011). Most glacial meltwater comes from the mainstem Stehekin River and Agnes Creek, which contains the largest glacier in the watershed, the Chickamin Glacier (1.8 square miles) (Post et al. 1971).

Because the river's headwaters originate near Cascade Pass along the Pacific Crest, it receives the heavy precipitation characteristic of the west side of the Cascades. Steep slopes, a dense network of steep tributary streams, and the circular shape of the watershed also contribute to the frequent and rapid rise of floodwaters in the lower valley.

Lake Chelan is a natural lake, 50 miles long and 1,500 feet deep, with a variable width of about 1.2 miles. The upper four miles of Lake Chelan are in Lake Chelan NRA. The dam raised the water level in the lake by 21 feet, giving it a full-pool surface elevation of approximately 1,100 feet amsl. Lake levels fluctuate seasonally, with an average drawdown of 18 feet by late winter / early spring to accommodate snowmelt for hydropower generation. Full pool usually occurs in late July (NPS LACH 2008b:151). A 2001 study indicates that at full pool, Lake Chelan's backwater effect extends at least 0.25 mile upstream (Chelan PUD 2001b).

Photo 15 – Deep pool on Stehekin River at Buckner Rock.

## Climate

The Stehekin watershed climate varies by elevation and distance from the Pacific Crest. The North Cascades create a strong rain shadow on the leeward (east) side of the range. The Stehekin Valley climate is generally characterized as continental, with cold, wet winters and hot, dry summers. Prevailing westerly winds bring a steady winter flow of storms and precipitation from the Pacific Ocean (see Table III-2: *Stehekin Temperature and Precipitation Extremes*). High-elevation headwater areas along the crest receive about 150 inches of precipitation a year, including approximately 20 - 30 feet of snowfall. At the opposite extreme, at the low-elevation eastern end of the watershed in Stehekin, annual rainfall is about 35 inches. Most of the precipitation within the watershed falls as snow between November and March, with average annual snowfall at Stehekin 10.3 feet. The mean annual temperature for the period 1979 to 2010 is 47.5 degree Fahrenheit.

**Table III-2: Stehekin Temperature and Precipitation Extremes**

| Measurement | Minimum | Maximum |
|---|---|---|
| Extreme annual temperature (2 years in 10) | –6°F | 100°F |
| Average daily winter temperature range | 24.6°F | 35.4°F |
| Average daily summer temperature range | 50.8°F | 79.4°F |
| Extreme annual precipitation (2 years in 10) | 24.0 in. | 42.7 in. |
| Average annual monthly precipitation range | 0.5 in. (Jul) | 6.6 in. (Dec) |
| *Source: NPS LACH 1995a:200* | | |

## Hydrology and Streamflow

Floods can occur at several times a year on the Stehekin River. Summer flooding occurs during thunderstorms and associated periods of intense rainfall but usually affect small areas. Spring floods occur in May or June during peak snowmelt. The magnitude of these floods varies, depending on the winter snowpack and spring weather (precipitation, freezing level, and temperature). Spring floods can persist for weeks, with river level fluctuating in response to daily cycles of snowmelt. Fall and early winter floods are larger than spring floods, but usually pass within a few days. These occur during heavy rainfall and are usually associated with unusually warm temperatures (high-elevation freezing levels) and often a preexisting snowpack (rain-on-snow events) (NPS NOCA 2008b:152).

The geology and shape of the Stehekin River watershed contributes to the valley's frequent and large floods (see Figure I-7: *Magnitude and Timing of the Annual Peak Flood on the Stehekin River*). Resistant bedrock, steep slopes, and a well-developed drainage network feed rain and snowmelt water rapidly to trunk streams. The three main branches of the Stehekin River join within five miles, bringing floodwaters together in deep bedrock canyons that deliver the floods rapidly to the lower valley, along with large amounts of gravel and large woody debris.

The floods of 1995, 2003, and 2006 were fall rain-on-snow floods. Unlike the 1995 and 2006 events, which took weeks to build, the 2003 event happened in ten days and occurred early in the flood season, on October 20.

Like their drier eastside counterparts, the Stehekin River and its tributaries flood during periods of rapid snowmelt in May and June. The fourth-largest flood on record was a spring flood that occurred in 1948, with a peak discharge of 18,900 cubic feet per second (cfs). The largest spring floods occur when an above-average snowpack persists late into the spring and is melted rapidly by high temperatures and/or heavy rainfall. The average spring flood on the Stehekin River is about 9,000 cfs. The large 1997 spring flood had several peaks above 10,000 cfs and persisted into July.

Eastern Stehekin River tributaries, including Bridge, Rainbow, and Boulder creeks, are currently dominated by spring snowmelt floods. In fact, none of these tributaries underwent substantial flooding in 1995, 2003, or 2006, and the flood of record for these streams remains the spring 1948 event. Current weather patterns appear to have moved the Stehekin River's flood hydrology toward smaller spring snowmelt floods and larger, more frequent fall rain-on-snow floods.

### River Characteristics

**Main Channel:** The channel currently occupied by the main flow of a river, with the fastest, deepest water.

**Side Channel:** Channels peripheral to the main channel that may or may not have flowing water in them at all times. Side channels can also be abandoned main channels.

**Reach:** The length of a stream channel that is uniform with respect to discharge, depth, area, and slope; also the length of a stream between two defined stations.

**Gradient:** Degree of inclination of the part of the earth's surface; steepness of slope. Gradient may be expressed as a fraction, ratio, percentage, or angle.

**Sinuosity:** A quantifiable value to measure the degree to which a river channel meanders.

**Bankfull Stage:** The elevation of the water surface of a stream flowing at channel capacity.

### Topographic Features

**Alluvial fan:** A gently sloping deposit of sand and gravel left by a stream. Viewed from above, it has the shape of a fan.

**Debris Cone:** A deposit with a shape like a fan, steeper than an alluvial fan, formed by active debris torrents and flooding.

**Lateral Moraine:** A low ridge deposited along a mountain glacier, composed of a wide range of material from silt to large boulders.

### Channel Characteristics

**Substrate:** Gravel and cobbles on the bed of a stream that provide habitat for some organisms.

**Riffle:** Part of a stream where water flows over a gravel bar, with gradients usually between one percent and 3.5 percent.

**Pools:** Deep sections of a river channel between riffles and near logjams or larger rocks, with gradients usually under one percent. Pools are important habitat for river life during storm events and dry periods of low flow and high temperatures.

Small, steep, first- and second-order tributaries in the valley are prone to flash flooding in summers as a result of intense thunderstorms. Those streams in southwest-facing valleys in the lower Stehekin Valley are particularly prone to debris torrents triggered by heavy rainfall.

### *Flood Magnitude and Frequency*

The Stehekin River has been gauged almost continuously since 1911 by the USGS (#12451000). The flood history on the river contains both fall rain-on-snow and spring snowmelt floods. Until 1995, the largest flood on record was the 1948 spring event, and six of the seven largest floods occurred during the spring. On November 29, 1995, a flood equaling the 1948 event passed down the Stehekin River. It was followed by large spring floods in 1997 and 1999, and two large fall floods in October 2003 and November 2006.

The 2003 event had a peak discharge of 25,600 cfs, and is estimated to have only a one in 500 chance of occurring in any given year (see Table III-3: *Comparison of Two Methods for Estimating Flood Frequency and Magnitude on the Stehekin River*). It is by far the largest flood on record for the Stehekin River, with a discharge about 30 percent greater than any other large flood since 1911. The 2003 flood was not the flood of record on the adjacent Skagit, Methow, or Entiat Rivers, underscoring the flood-prone nature of the Stehekin River.

Given the narrow box canyons on the lower Stehekin River and Agnes Creek, it is possible that failure of a temporary debris dam in the canyons led to the high 2003 peak discharge. Review of available satellite (Landsat) images and inspection of the Stehekin River canyon above High Bridge did not reveal any evidence of a temporary dam. Undercutting of a 50-foot-tall bank four miles above High Bridge and evidence of very high water near Tumwater Bridge two miles downstream, however, may support the inference of a debris dam.

A research project written for the relicensing of the Lake Chelan Hydroelectric Project has added some perspective to understanding Stehekin River hydrology. In 1999, Bob Jarret of the USGS estimated the largest possible flood on the Stehekin River at 36,000 cfs, considerably larger than the 2003 event. This estimate, however, is based on geologic data and should be considered a rough estimate. Further, it is possible that a flood of this magnitude occurred many thousands of years ago under different climatic conditions, or that it was related to a debris dam burst event. The other large floods on the Stehekin River since 1911 are given in Table III-4: *Chronology and Features of the Ten Largest Floods on the Stehekin River*. This table also shows the likely reoccurrence interval of these floods based on data recorded at the gauge between 1911 and 1917 and 1927 and 2007.

Passage of the large floods in 1995, 2003, and 2006 has shifted the magnitude-frequency relationship toward larger, more frequent floods. This coincides with a general shift in the late 1970s from a spring snowmelt-dominated system to one dominated by fall and early winter rain-on-snow flooding (see Figure I-7: *Magnitude and Timing of the Annual Peak Flood on the Stehekin River*). The shift to a fall rain-on-snow-dominated flood regime on the Stehekin River means that events like those in 1995 and 2006 may be typical for this system in the foreseeable future. Jarret (1999) noted that probable maximum floods on west-slope Cascade streams are larger than their eastside counterparts. How far the Stehekin River watershed moves toward a west-slope-type flood system remains to be seen. Considering the flood-prone nature of the Stehekin system, a shift toward larger, more frequent fall flooding, and channel changes caused by the three large recent fall floods underscores the need for careful land use planning.

**Table III-3: Comparison of Two Methods for Estimating Flood Frequency and Magnitude on the Stehekin River**

| Recurrence Interval (probability in given year) | Discharge (cfs) for Combined Fall and Spring Floods (85 events) | Discharge (cfs) for Spring Floods Alone (70 events) | Discharge (cfs) for Fall Floods Alone(16 events) |
|---|---|---|---|
| 10 years (0.1) | 14,950 | 13,740 | 21,360 cfs |
| 20 years (0.04) | 17,560 | 15,100 | 26,220 cfs |
| 50 years (0.02) | 19,490 | 16,190 | 29,850 cfs |
| 100 years (0.01) | 21,400 | 17,910 | 33,490 cfs |
| *Note: This approach is used to analyze flood records with mixed fall and spring floods.* | | | |

**Table III-4: Chronology and Features of the Ten Largest Floods on the Stehekin River**

| Date | Flood Type | Discharge (cfs) | Recurrence Interval |
|---|---|---|---|
| October 20, 2003 | Intense rainfall and rain on snow | 25,600 (estimated) | Probability 0.01 |
| November 29, 1995 | Rain on snow | 20,900 | 100 years |
| November 07, 2006 | Rain on snow | 19,100 | 100 years |
| May 29, 1948 | Snowmelt | 18,900 | 100 years |
| November 07, 1948 | Rain on snow | 18,400 | Probability 0.02 - 0.04 |
| December 26, 1980 | Rain on snow | 17,300 | Probability 0.02 |
| June 16, 1974 | Snowmelt | 16,600 | Probability 0.04 |
| November 24, 1990 | Rain on snow | 14,700 | 10 years |
| June 02, 1968 | Snowmelt | 14,400 | 10 years |
| June 10, 1972 | Snowmelt | 14,400 | 10 years |
| June 21, 1967 | Snowmelt | 13,900 | Probability 0.1 |

For the period of record, mean monthly low flows (i.e., base flow) ranged from approximately 400 to 600 cfs. During summer, glacial melt buffers what would otherwise be lower flows for the Stehekin River.

The estimated discharge of flooding has been calculated for the Stehekin River for the 10-, 50-, 100-, and 500-year floods. Frequency estimates are based on the log-Pearson Type III analysis by the USGS Water Resources Division (NPS LACH 2005). Recent flooding on the Stehekin River has caused major changes in the river channel and its floodplain. Flooding of some areas is now occurring during lower flow conditions because of where the river is located in the floodplain and because of gravel accumulation in the channel. Ongoing bank erosion, as the river occupies new or former parts of its floodplain, as well as periodic mass wasting events (landslides) and loss of portions of the Stehekin Valley Road have contributed to this naturally high sediment load.

### *Stehekin River Floodplain and Channel Migration Zone*

Floodplains are a very important component of a river. They slow and disperse the energy of floodwaters, providing diverse habitat for wildlife and plants that thrive on flood disturbance. Large woody debris and variably textured river sediment is stored in the floodplains, increasing biodiversity. As described in the Lake Chelan NRA GMP/EIS (NPS LACH 1995a), the floodplain performs several important functions, including (1) conveying and storing floodwater, (2) storing river sediment, (3) supporting a variety of plants that provide food and habitat to a rich diversity of wildlife species (large floods may scour out an area exposing spawning gravels for fish, or conversely may pile up logs and woody debris and form a logjam that becomes cover for fish and other wildlife), and (4) groundwater recharge.

The Stehekin River's floodplain and existing and former flood channels comprise much of the valley floor. The 100-year floodplain of the Stehekin Valley has been mapped by FEMA and the NPS based on a one-dimensional hydraulic model (Riedel 1993 Stehekin Floodplain Mapping Project NPS 1993b) (Figure III-4: *Channel Migration Zone in the Lower Stehekin Valley*). Over time, the river has occupied most of the valley floor, defining the channel migration zone (CMZ), although tributary alluvial fans and terraces stand above this zone. The CMZ is not significantly different than the 100-year floodplain (Figure III-4). The two main areas inside the CMZ but outside the floodplain are the terraces at Buckner hayfield and pasture and on the south side of the river across from McGregor Meadows. Both terraces are being rapidly eroded and will likely become part of the floodplain within a century.

Movement of the Stehekin River across its floodplain will continue to occur, with the passage of floods as the temporary storage of gravel and large wood causes the river to change course. The pattern of depositional (unstable) and transport (stable) zones is clear in the landforms maps, and is confirmed by the gravel and large wood surveys described below. It is a natural occurrence for the river to produce flows that cannot be contained within its stream channel. During flood events, the river jumps out of its channel and flows relatively slowly at shallow depths through the floodplain. Large floods, sediment movement, and the presence of semi-stable large woody debris make the channel and floodplain ever-changing.

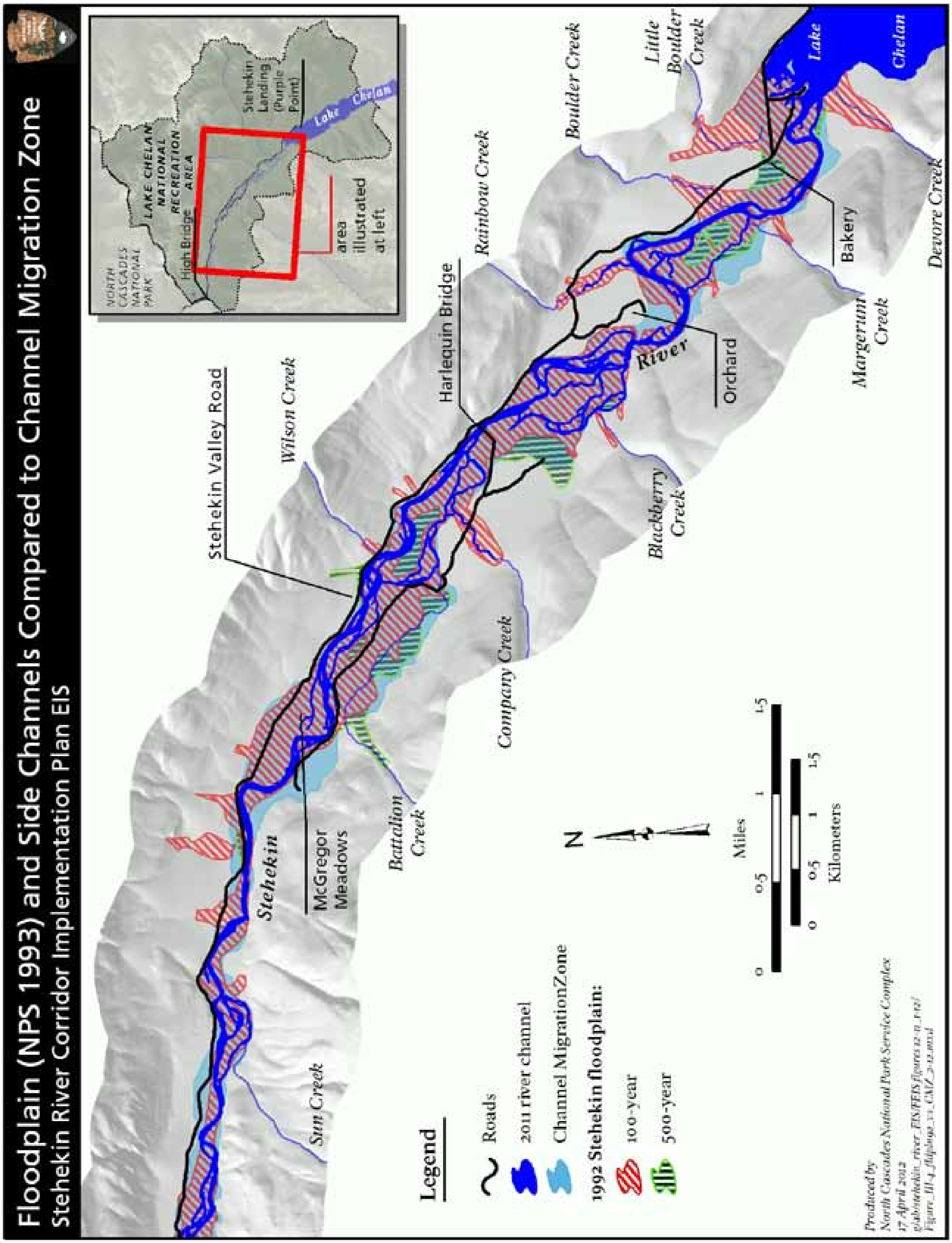
River channel patterns in the lower Stehekin Valley are variable. The Stehekin River is generally a single channel with stable side channels and islands. In some places it becomes wider and can have multiple braided channels, or wide meanders. Areas of sediment storage in the lower valley are marked by channel instability and wide floodplains. These deposition zones occur at McGregor Meadows where the valley width increases threefold, where the river meets the lake, and between the alluvial fans. Between deposition zones, the floodplain and river channel are relatively narrow as it traverses the upstream edge of the three alluvial fans. Within these transport zones the channel is stable, and there is relatively little storage of wood, gravel, or water.

### *Sediment Movement and Storage*

The annual total sediment load that the Stehekin River has been estimated to carry is substantial and comes from multiple sources. The amount varies significantly over time, with most moved during big floods. The size of material carried by the Stehekin River also varies considerably within the lower valley.

While modern glaciers cover but a small fraction of the Stehekin watershed, extensive deposits were left by ice age glaciers between 30,000 and 12,000 years ago. These deposits are as much as

**Figure III-4: Channel Migration Zone in the Lower Stehekin Valley**



several hundred feet deep in the wide, upper parts of the watershed. Some of these deposits are perched adjacent to the channel and active floodplain. Together with gravel produced by steep tributary streams and landslides, the glacial gravels introduced by bank erosion during modern floods contribute to the gravel load of the Stehekin River and river channel instability in the lower valley. Identified large glacial gravel sources include the Shady Slide one mile below the mouth of Bridge Creek and the Cottonwood Terrace eight miles above Bridge Creek. With the exception of numerous river-cut banks in the lower valley below High Bridge, all of the major gravel sources in the upper valley are in designated wilderness. Cut banks in the lower valley have supplied about 500,000 cubic yards of gravel since 1962.

Sediment transported through the bedrock-walled Stehekin and Agnes gorges above High Bridge is stored at various points in the lower valley. Major points of deposition include areas where valley width increases, such as McGregor Meadows, and between the large alluvial fans of Company, Boulder, and Rainbow Creeks. In the McGregor Meadows area above the logjam, it is estimated that about 44,000 cubic yards of gravel were deposited by floods between 1986 and 2007 (see Appendix 18: *Estimates of Gravel Accumulation in Two Reaches of the Stehekin River*). Another major sediment deposition / storage point is where the river enters the slack-waters of the lake.

The load of the Stehekin River undergoes a dramatic transition in the lower valley, changing from cobbles and boulders near McGregor Meadows to pebbles, gravel, and sand within eight miles, at its margin with Lake Chelan. Changes in the size of the gravel mirror changes in the gradient of the channel profile. At its confluence with Agnes Creek, the Stehekin River gradient is about 80 feet per mile. Above McGregor Meadows, the river moves cobbles and small boulders along its bed, and its gradient is approximately 50 feet per mile (one percent). By the time it reaches Lake Chelan, seven miles downriver, the gradient decreases to about 25 feet per mile (0.5 percent) and the bed load is sand and pebble gravel. Within straight, narrow reaches in the lower valley, including between river miles 1.2-2, 3.5-4, and 6.5-7, the Stehekin transports clasts with median diameters of 38 - 64 inches. These areas correspond with the more stable channel zones described above and the wood transportation zones discussed below, while areas of smaller-diameter gravels correspond with areas of increased floodplain and channel width and wood storage zones. At finer scales of resolution, pockets of sand are found in pools and near logjams.

Large bed load, rapid sediment movement during floods, and rapid changes in stream capacity to move material of different sizes create instability in the deposition zones of the lower Stehekin River channel. Often, coarse material deposited during a large flood is abandoned by the river as it erodes into finer-grained material. Coarse gravel deposits often form the core of a building river terrace. This often leads to bank erosion in reaches that are also characterized primarily by channel deposition.

Several studies have attempted to estimate the amount of sediment that the Stehekin River moves annually. In a survey of sites in the upper Columbia River basin of Washington State, Nelson (1974) estimated annual suspended sediment load on the Stehekin River (silt, clay, and fine sand) at 19,400 cubic yards per year, which was comparable to the Methow River near Pateros. Nelson measured suspended load concentration as high as 22 milligrams/liter during a 7,000 cfs flow event on the Stehekin River in June of 1970; however, he did not attempt to measure the total load of the river (bed load and suspended load).

In 1999, the NPS used growth of the delta from Buckner Homestead hayfield and pasture to the Landing over a 9,000-year period to estimate mean annual total sediment yield at 25,000 cubic yards. This estimate does not include silt and clay carried deeper into Lake Chelan and not deposited on the pro-grading delta. Considering the indirect method of measurement used by the NPS, the 25,000 cubic yard per year estimate should be viewed as a rough approximation. Whether the actual value is significantly lower or higher, the amount of sediment the Stehekin River moves is impressive, and comparable to other large rivers in the Pacific Northwest (Table III-5: *Comparison of Stehekin River Sediment Yield*).

**Table III-5: Comparison of Stehekin River Sediment Yield**

| River System | Load Type[a] | Sediment Load ($yd^3/mi^2/yr$) |
|---|---|---|
| Stehekin | Total | 28 |
| Skagit[b] | Bed | 12 |
| Columbia - North Pacific[c] | Total | 340 |
| Rocky Mountain region[d] | Total | 84 |
| Sierra Nevada[d] | Total | 410 |
| Coast Range, Oregon[d] | Total | 207 |
| Amazon[e] | Total | 58 |
| Mississippi[e] | Total | 207 |

[a]*Load types include dissolved, suspended, bed, and total.*

[b]*Stewart and Bodhaine 1961.*

[c]*U.S. Water Resources Council 1968; average sediment yield for drainage areas <100 miles$^2$.*

[d]*Geiger 1958; sediment yield from studies of reservoir deposits in small watersheds.*

[e]*Sundborg 1983.*

The bedload (gravel) component of steep rivers such as the Stehekin is typically greater than 11 percent (Schumm 1963, 1977). Use of the total and suspended load estimates given above indicate that the bed load of the Stehekin River comprises about 17 percent of the total load, or 5,600 cubic yards per year. Annual bed load transported probably varies by 50 percent or more, with larger quantities moved during large flood events.

Considering a relative lack of change in the position of the channel at the river mouth and other important locations, it appears that at least some of the gravel was being transported through the lower Stehekin Valley prior to deposition of the massive 2003 flood gravels. Gravel bars have grown, increasing river meandering and bank erosion, but the elevation of the river bed has not increased significantly.

### *Large Woody Debris Accumulation*

Due to its relatively wet climate, the Stehekin Valley contains a lot of large trees for a watershed on the eastside of the Cascades. Logjams form in several locations along the Stehekin River, including at the entrances to side channels, on mid-channel gravel bars, and on gravel bars adjacent to side channels and points of overbank flow. Historically, large logjams were removed. Below Harlequin Bridge, the Army Corps of Engineers removed most large wood piles as recently as 1972.

Large woody debris has a valuable place in the ecological processes of the Stehekin River system. It provides habitat and shelter for fish, insect, bird, and mammal species using the river corridor.

Large woody debris provides nutrients by depositing and collecting organic matter in the river, and also serves to spread floodwater and slow velocity during flood events. Logjams provide erosion protection and catch other debris in the river system. They also cause localized scouring and pool formation.

Three comprehensive inventories of large wood accumulations in 1984, 2000, and 2007 have documented rapid accumulation of wood on the lower Stehekin River (Figure III-5: *Large Woody Debris Accumulation on the Stehekin River 1984 - 2007*). In 2000, the total volume below Bullion Raft Launch was estimated at 130,000 cubic yards; in 2007, at 370,000 cubic yards.

Following the large recent floods, massive new accumulations of wood now occur below High Bridge, at the mouth of the canyon, at McGregor Meadows, and at the river mouth. Two particularly large logjams have formed in the past 15 years in the McGregor Meadows area. Combined, they cover an area of almost five acres and contain more than 3,000 large logs stacked as high as 20 feet (Figure III-6: *Large Wood and Gravel Transport and Deposition Zones* and Figure III-7: *2007 Large Logjam Locations*).

Several dozen logjams in the lower valley have become stable features of the floodplain. Many of the logjams have grown with passage of the 1995, 2003, and 2006 floods. While the number of logjams has remained constant in some locations, at other sites logjams have formed, been removed, and, in some cases, reformed.

**Figure III-5: Large Woody Debris Accumulation on the Stehekin River 1984 - 2007**

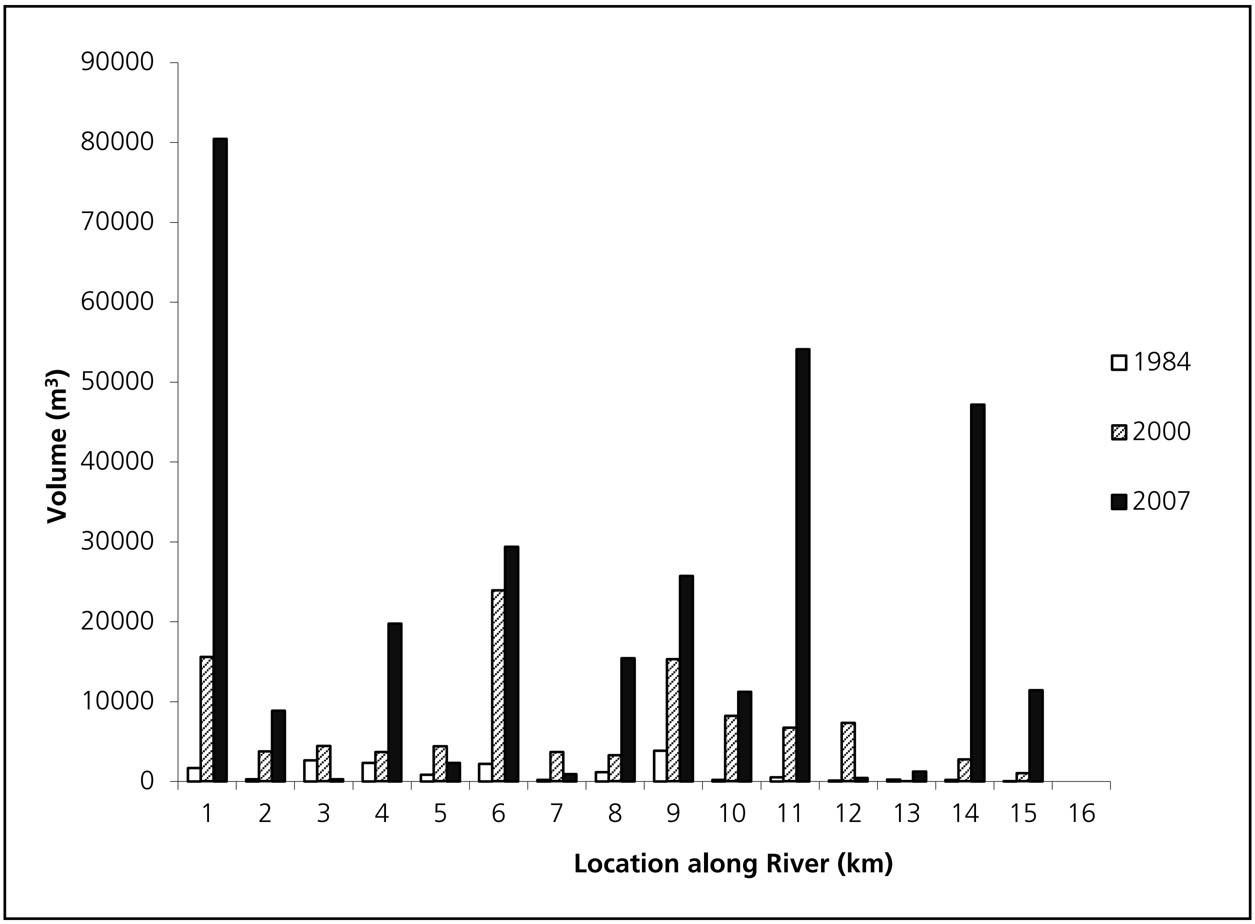


**Figure III-6: Large Wood and Gravel Transport and Deposition Zones**

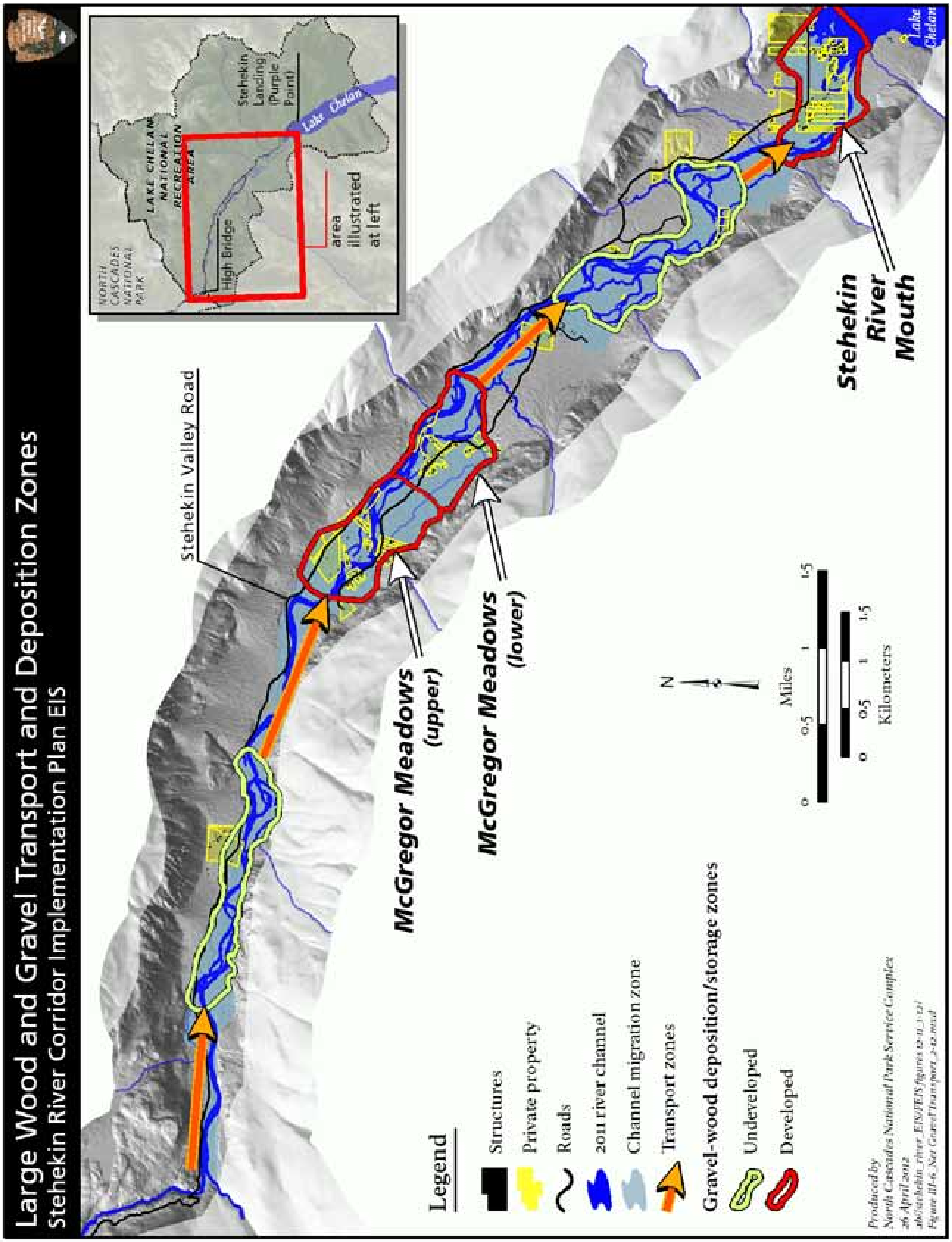
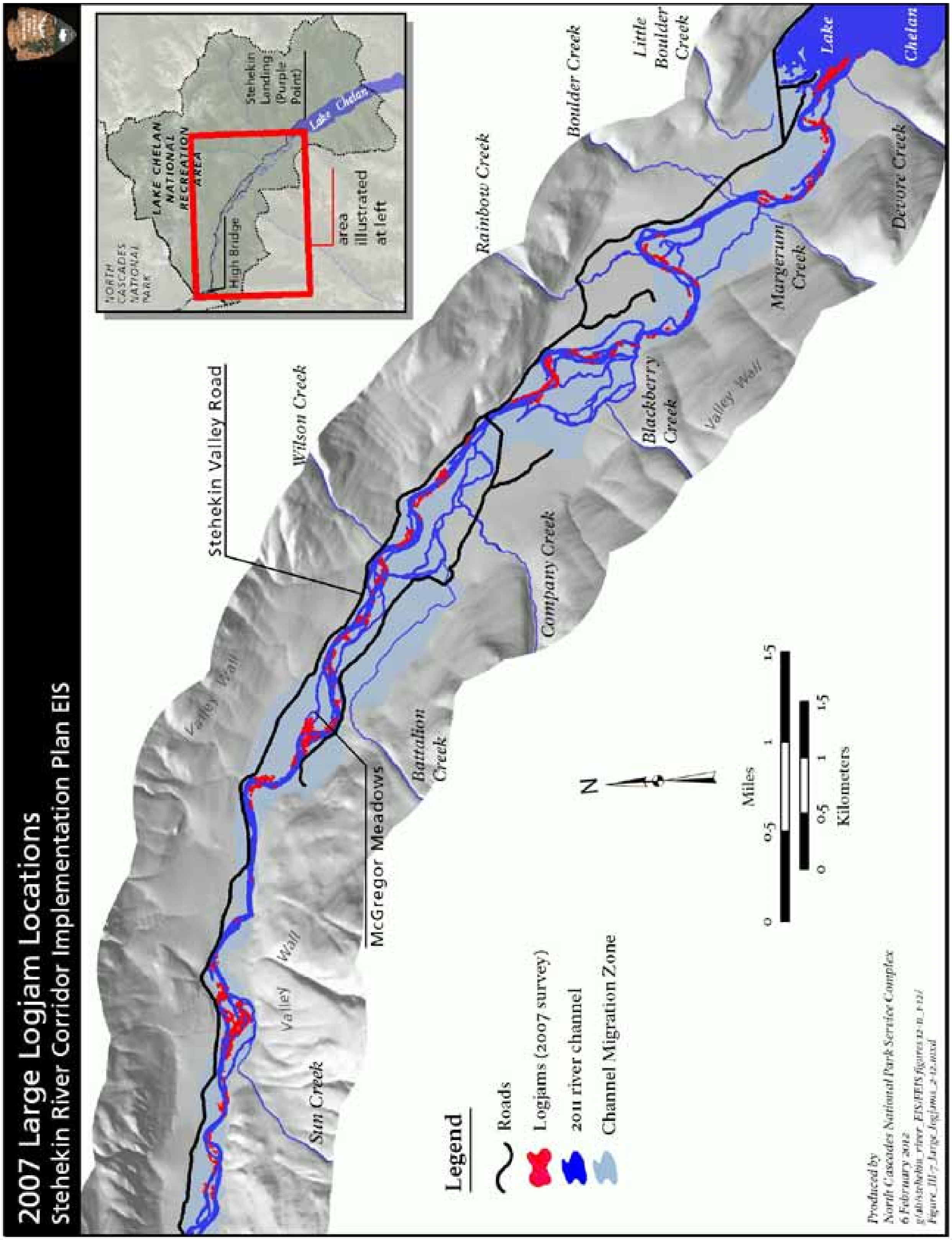


**Figure III-7: 2007 Large Logjam Locations**



The effect of the large woody debris accumulations is generally to increase hydraulic roughness (resistance to flow) and width-to-depth ratio, while reducing sinuosity and flood flow velocity. The presence of large wood makes the Stehekin more like a west-slope stream than its neighbors on the east slope of the Cascades. Thus, the Stehekin is a shallower stream than is typically found on the east slope of the North Cascades (Southerland 2003). It has been suggested that large woody debris deposited in sites with dense streambank vegetation can facilitate gravel transport (Riedel 2007).

### *Application of Hydrology, Flooding, Channel Migration Zone, Sediment Deposition, and Large Woody Debris Studies*

Two sites in the lower Stehekin Valley with persistent flooding and erosion problems stand out when examining the information summarized above. These sites are both areas of sediment and large wood storage that have extensive development in the floodplain and along the river. There are different reasons, however, why these sites have unstable channels and persistent flood issues.

#### McGregor Meadows

At McGregor Meadows, the width of the Stehekin Valley increases threefold, and as a result the gradient drops and sediment and logs are deposited. Through the process of river migration away from the coarse gravel left by the big floods, the channel has become particularly unstable. The position of the Stehekin River channel has been plotted at various times since 1953. In the

Photo 16 – Logjam at McGregor Meadows. Combined with another logjam on the other side of the river, this feature covers nearly five acres, contains more than 3,000 logs, and is 20 feet deep in places.

McGregor Meadows reach, channel sinuosity has increased as floods of the past half-century have filled the main channel with gravel, which causes erosion of streambanks and deposition of large woody debris (Figure III-8: *Stehekin River Channel Migrations 1953 - 2011*).

The NPS has observed a three to four foot increase in the elevation of the bed of the Stehekin River in upper McGregor Meadows in the past 21 years. This represents about 44,000 cubic yards of material (see Appendix 18). Following the 1995 flood, a private consultant and NPS river managers determined that the loss of channel conveyance due to gravel accumulation on the river bed would ultimately result in a channel shift to the left bank, through McGregor Meadows along No Name Creek. Growth of a log jam has blocked the entrance to this route, however, and the river appears to be seeking a new path a few hundred feet upstream. It is also possible that continued deposition of wood and gravel in the channel will result in the river breaking out of its channel farther upstream and following the Stehekin Valley Road through McGregor Meadows.

In response to the formation of pilot channels in McGregor Meadows, about ten grade-control structures were installed on private land along the left (north) bank floodplain in the late 1990s. Grade-control structures are essentially trenches filled with large rocks and gravel that are built perpendicular to flow. They are designed to spread water out across a floodplain and to prevent flood channels from enlarging. Since the tops of these structures are at grade, they are not visible and do not raise the water surface elevation of floods. In response to overbank flooding and scour of roads upstream and on the opposite bank, five additional grade-control structures were installed at two sites by the NPS in 2007.

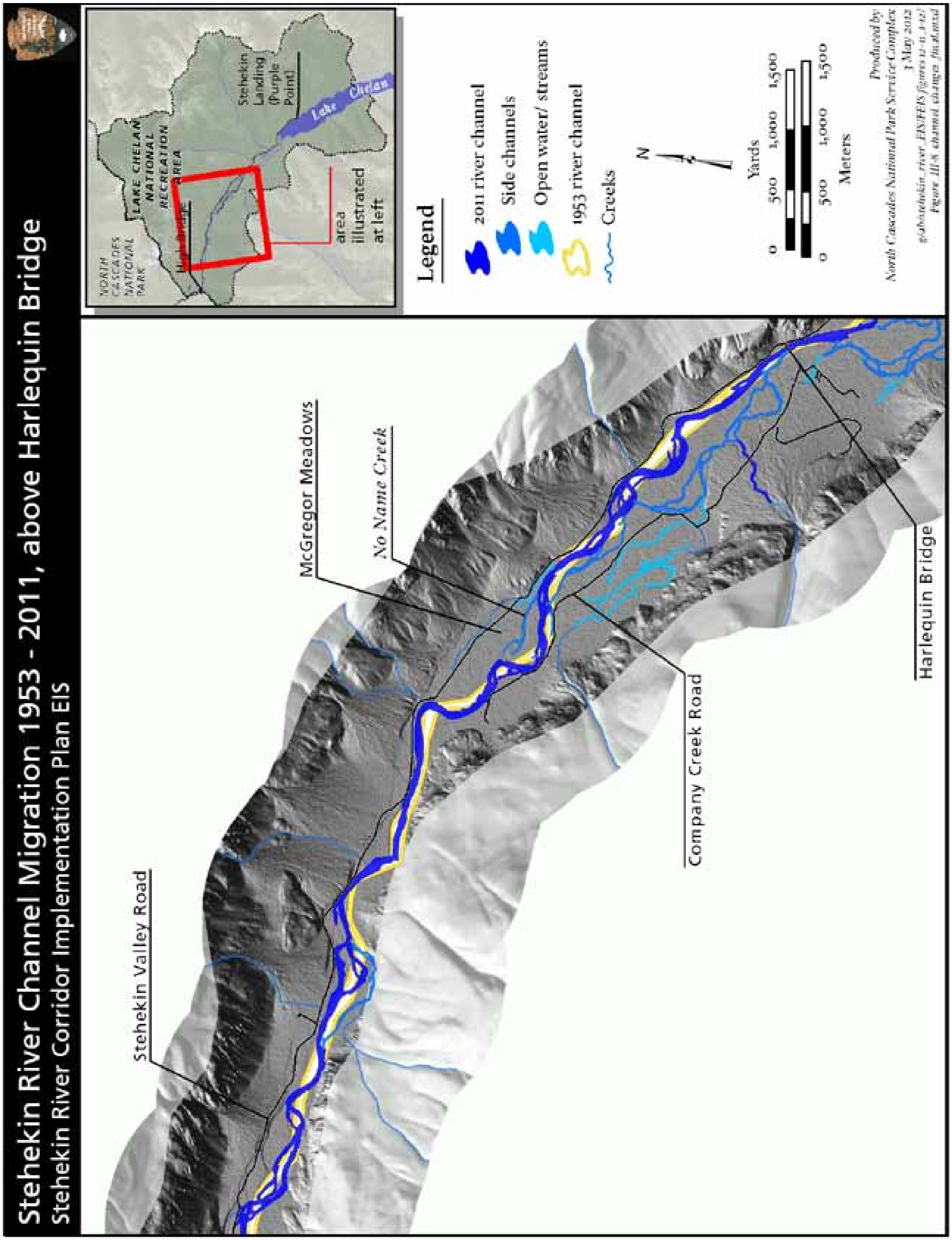
Along the opposite bank, filling of the main river channel with gravel has led to rapid bank erosion of the right bank. The NPS has installed ten rock barbs in a half-mile-long reach to slow erosion, while private landowners have placed another three barbs on the other side of the channel.

### Stehekin River Mouth and Lake Chelan

Deposition of gravel and large wood, and channel instability, also occur where the Stehekin River enters Lake Chelan. In a 2001 study, Chelan PUD used a hydraulic model to analyze the effects of manipulating the level of Lake Chelan on the Stehekin River (Chelan PUD 2001b). They showed that the backwater effect of Lake Chelan at full pool when river discharge is 20,000 cfs (i.e., a 100-year flood) extends nearly 0.25 mile upstream of the river mouth, raising the 100-year flood elevation 0.5 foot. The backwater effect extends several hundred feet farther upstream for smaller floods that occur at full pool. No effect from Lake Chelan was observed when the lake level is below 1,094 feet. When the lake is lower than this level, more gravel is transported deep into the reservoir.

The effect of the lake backwater is to slow river velocity and cause gravel deposition and accumulation of large woody debris. Further, Chelan PUD modeling of the effect of large wood on floodwater surface elevations near the river mouth indicated that logjams blocking side channels on the right bank raise the water surface elevation another 0.5 - 1.0 foot. In summer 2007, one of these logjams was removed from the head of a side channel near river mile 0.5 on the right bank. This channel was occupied by the river prior to the 1948 flood, and is known as the 1948 flood channel. A large spring flood in 2008 blocked this side channel with logs again, but they were removed the following fall. A comparison of channel surveys taken in 2000 and 2010 indicates about 60,000 cubic yards of gravel accumulated in the lower half mile of the river (see Appendix 18).

**Figure III-8: Stehekin River Channel Migrations 1953 – 2011, above Harlequin Bridge**



### *Response to Flooding and Erosion on the Stehekin River*

Stehekin River Modifications: The earliest channel modifications to the Stehekin River were made in the 1930s by Chelan PUD, although removal of logs was a continuing historic practice until about 1972. By 1995, approximately 3.9 percent, or 4,861 feet, of the banks of the Stehekin River below High Bridge were affected by engineered erosion protection or flood-control structures (NPS 1997:13). By September 2001, approximately 6,965 feet, or 5.6 percent, of the Stehekin River banks were hardened (NPS 2007a). Today, approximately 8,211 feet, or 6.5 percent, of the Stehekin River is affected similarly (Table III-6: *Lower Stehekin River Shoreline Affected by Erosion or Flood Control Structures*).

**Table III-6: Lower Stehekin River Shoreline Affected by Erosion or Flood Control Structures**

| Erosion Protection Structures | 1993 | 1994 - 2001 | 2002 - 2009 |
|---|---|---|---|
| Number of Sites | 28 | 35 (with 80 structures) | 46[a] |
| Length | 4,861 ft | 6,965 ft | 8,211 ft[b] |
| Number of Barbs | 0 | 10 | 30[c] |
| Percentage of Bank | 3.9 | 5.6 | 6.5 |

*Note: Total shoreline length (estimated left and right banks) is 124,847 feet.*

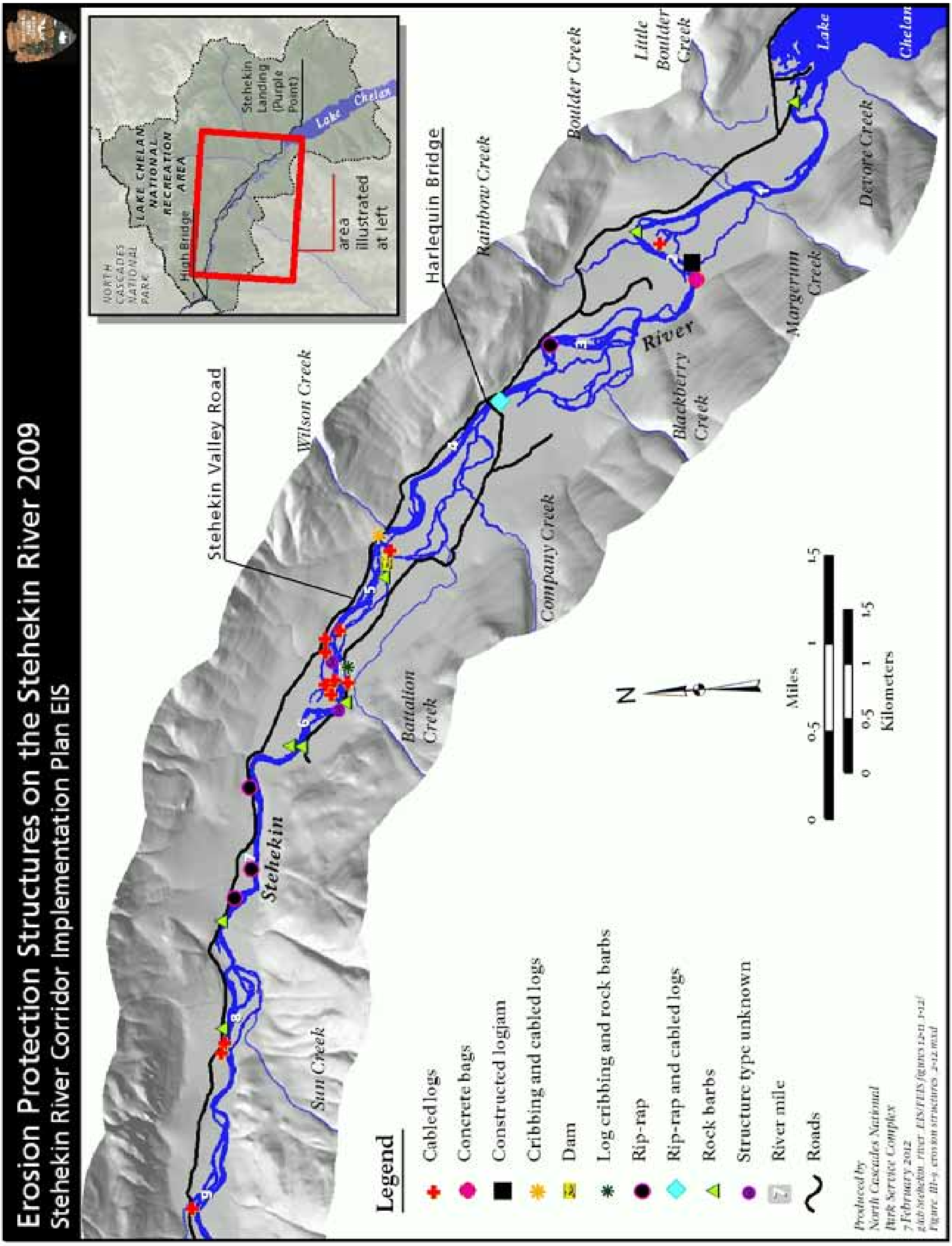
*[a] Sites added since 2001 - 02 are upper Company Creek Road (2007), Courtney Ranch (2007), Scutt (2007), and Leader Levee (2008).*
*[b] Added 427 feet to upper Company Creek Road, 427 feet to Milepost 8.0, and 328 feet to Leader.*
*[c] NPS added six barbs at Milepost 8.0 (1993, 2008), ten barbs at Company Creek Road (1997, 2007), and four barbs near the orchard (1999). Private owners added two barbs on Leader (1997), four barbs at Stehekin Valley Ranch (2007), one barb at Company Creek Road (1997), and three barbs near the River Resort Road (1997).*

The USGS studied the effects of rock groins and rip-rap on stream velocity (Nelson 1986) at several sites. The NPS examined the hydraulic effect of rock barbs using two-dimensional models at upper Company Creek Road and at Stehekin Valley Road Milepost 2.2. Based on the models and direct observations, barbs decrease bank erosion, but cause increased scour of the channel bed within a few hundred feet downstream of the lowest barb on same side of the river. In contrast, rip-rap tends to draw and hold the fastest and deepest water against itself and can cause bank erosion downstream.

Erosion protection structures have proliferated on the lower Stehekin River in the past 15 years in response to flooding and river channel changes. During this period rock barbs became the preferred measure of bank-erosion management, although rip-rap and cabled logs are also common. In 1993 the first two rock barbs were installed by the NPS at Milepost 8.0 after the 1990 flood. Ten barbs were installed on public land at two sites and five on private land at three sites following the 1995 and 1997 floods. In response to bank erosion from the 2003 flood, eight more rock barbs were added by the NPS on upper Company Creek Road and Milepost 8.0 and four barbs were added on private property at the Stehekin Valley Ranch. In total there are now 30 rock barbs on the river, with most (13) located in the McGregor Meadows area (Figure III-9: *Erosion Protection Structures on the Stehekin River 2009*).

Only two extensive flood-control projects are in place in the lower Stehekin Valley: A 400-foot-long, four-to-five foot-tall levee was constructed by the NPS in the early 1980s along the upper Company Creek Road at Milepost 5.5, and a 300-foot-long, three-foot-tall levee was constructed on private land in McGregor Meadows in 2008.

**Figure III-9: Erosion Protection Structures on the Stehekin River 2009**



Models comparing existing conditions to proposed alternatives were constructed in 1997 and 1998 to assess the impacts of barbs and rip-rap on channel hydraulics downstream. They were developed to evaluate (1) local-scale effects and (2) reach-scale effects of the alternatives. The two-dimensional local-scale models were quite detailed and examined the maximum flows contained within the channel for the rock barb and rip-rap alternatives at upper Company Creek Road (1997) and Stehekin Valley Road Mile 2.8 (1998). The reach-scale model covered 1.06 miles and was less detailed, but included overbank and flood-prone areas within the study reach for low and high flows. The local-scale model was more useful for site-specific impact analysis, while the reach-scale model was useful for more general analyses. The reach-scale model analyzed the combined effects of ten rock barbs (three existing and seven proposed additional) for the 100-year flood and for average spring high flows. Because this model included areas of the channel with poorly defined topography and large, flat, flood-prone overbank areas, the model resolution was quite coarse. Therefore, the reach-scale model results for each alternative are less reliable than necessary to make local-scale interpretations. Flow modeling at both scales, however, seemed to agree with the hydraulic conditions predicted based on prior experience with rock barbs. These included no major displacement of energy or bank-erosion problems with rock barbs, but accelerated flow downstream with use of rip-rap. The downstream effect of barbs is approximately three to five times their length, or 80 - 100 feet.

## Water Quality

Water quality is determined by a measure of water temperature, dissolved oxygen, suspended sediment, nutrients, and chemical pollutants. Other parameters include conductivity, turbidity, pH, and mineral concentration. The concentrations and interactions of these factors affect the ability of fish and other aquatic organisms to survive. Generally, water quality parameters exhibit a great degree of natural variation among different water resources (rivers, streams, lakes, hot springs, etc.). Water quality also refers to the suitability of surface water for recreational use and wildlife habitat.

The water quality in the Stehekin River is generally excellent. An average of values from three stations below McGregor Meadows (River Mile 6) show: 10.7 mg/L of dissolved oxygen; 41.91 uS/cm (microsiemens per centimeter) specific conductance; 7.49 pH; and 1.22 Nephelometric Turbidity Units (NTUs) for turbidity. Temperature data is pending. There are relatively few potential sources of water pollution within the valley because of the limited development in the area. As the largest tributary to Lake Chelan (Figure III-1: *Stehekin River Watershed*), the Stehekin watershed has an important influence on water quality. The primary concerns associated with water quality, however are the superfund site at Holden, in the Railroad Creek Valley, and pesticides used on orchards, vineyards, and lawns at the south end of the lake. The Stehekin watershed primarily consists of designated wilderness. As a result, it primarily influences Lake Chelan by it's volume of inflow and fine-grained sediment.

Some potential sources of pollution also include nutrients and pathogens from septic systems, pesticides from farming or orchards (in particular, DDT has been a problem in Lake Chelan, but this pesticide was not extensively used in the Stehekin Valley), or pollutants in stormwater runoff, such as sediment. Analysis of 23 pesticide residue compounds in 1986 found only DDT and its associated metabolites in quantifiable levels; however, those near Stehekin were very low (Patmont et al. 1989 in NPS LACH 1995a:198).There may also be chemicals from various activities, such as small spills of oil or fuel from vehicles, or use of other toxic materials that can be taken up in stormwater runoff, such as fertilizers.

The Stehekin River is a Category I waterway under the *Water Quality Standards for Surface Waters of the State of Washington* (NPS NOCA 2006c). Category I waterways meet testing standards for clean water and are given maximum protection under state water quality regulations (Washington Administrative Code 173 201A). In addition, the surface water in Lake Chelan NRA has been determined to be Class AA (extraordinary). Class AA waters are also designated under state administration of the Clean Water Act and are characterized by exceptional water quality. Class AA waters are also given maximum protection under state water quality regulations (Washington Administrative Code 173-201A).

Although the Stehekin River is listed as Category 1, it does have higher levels of arsenic than the listed standard. When investigated, these were determined to be from a naturally high background concentration of that element (Johnson and Cassidy 1997; Patmont et al. 1989). Although these natural background concentrations exceeded the arsenic standard, they are natural conditions; therefore, they do not violate water quality standards.

Both flooding and human activities can affect a variety of water quality parameters, including sedimentation. Although flooding and sedimentation are natural processes, sustained high levels of sedimentation, or sedimentation which occurs during sensitive life stages, can affect fish and other aquatic organisms and cause stress or mortality. Given the frequent nature of flooding on rivers, organisms are somewhat adapted to disturbances. Pools and tributaries represent important refuge for aquatic organisms during disturbance events.

These habitats can be affected by sediment from bank erosion during flood events. The erosion and resulting sediment cause increased turbidity in the water, which can adversely affect fish and other aquatic organisms in several ways. Sediment can fill the spaces within spawning gravels, which adversely affects spawning success and can also destroy other fish habitat areas such as pools used by fry and juveniles. Sediment can also clog the gills of fish, impairing respiration or causing mortality.

Sediment can also change the chemical components of water quality, including dissolved oxygen, pH levels, or biological oxygen demand. This in turn may adversely affect aquatic species. According to the GMP/EIS (NPS LACH 1995a), the Stehekin River contributes approximately 4,120 metric tons of suspended sediment to Lake Chelan each year. This is evidenced by the large mudflat located at the mouth of the river at the north end of Lake Chelan. The GMP estimated that during a 12-year period, over 25,000 cubic yards of sand, rock, and gravel were used to maintain roads in the Stehekin Valley, and stated that the largest human-caused input of sediment to the Stehekin River and Lake Chelan is probably attributable to erosion from roads (NPS LACH 1995a:199).

Despite the impacts of sedimentation, erosion of riverbanks is a natural process, and the introduction of gravel and large woody debris provides a number of benefits for aquatic species, including the creation of side channels, pools, gravel bars, and logjams.

Other effects on water quality come from the contribution of nutrients and pathogens from septic drain fields, fertilizers, and other wastewater sources (such as from camping) within the Stehekin Valley. Of the inputs to the Lucerne and Wapato basins within Lake Chelan, those from the Wapato or downriver basin are primarily from human sources. According to the GMP (NPS LACH 1995a:198), approximately 25 percent of the phosphorus inputs in the Stehekin Valley are from agricultural runoff (23 percent) and septic systems (three percent). Pathogen inputs from septic systems normally is low, based on water quality testing by the Washington Department of Health at seven sites within the Stehekin Valley. Results met safe drinking water standards, however, during flooding, inputs may be higher, especially when these are incorporated into the river when houses are washed away.

## Wetlands

Wetlands are a critical resource that supports a high diversity of species. Wetlands and deepwater habitats (excluding Lake Chelan) cover approximately 584 acres within Lake Chelan NRA, including low-lying areas near the Stehekin River, along its tributaries and portions of the drawdown in Lake Chelan (NPS 1993b) (Figure III-10: *Wetlands in the Lower Stehekin Valley*). Of the 283 acres of developed land in the Stehekin Valley, there are an estimated 188 acres within the riparian zone. This development includes roads, houses, and administrative facilities. Some of this developed land includes wetlands.

Wetlands perform key ecological functions, including moderating surface and groundwater flow; controlling sediment transport, erosion, and deposition; mediating physical and chemical processes affecting water quality and nutrient cycling; and generating plants and providing food and habitat for animals (Strickland 1986; Kusler 1983 in NPS LACH 1995a:178).

Wetlands were mapped within the Stehekin Valley in 1990 with field observations and existing information, including National Wetlands Inventory maps, soil surveys, topographic maps, orthorectified aerial photography (1988), and the Stehekin Valley Habitat Types map (NPS 1993b in NPS LACH 1995a:178). Among the largest wetlands are a matrix of about 65 acres of forested and shrubby wetlands between Harlequin and Buckner Homestead hayfield and pasture, with another area of about 101 acres just above Harlequin. Another wetlands survey was conducted specifically for the SRCIP in 2011 along the Stehekin Valley Road.

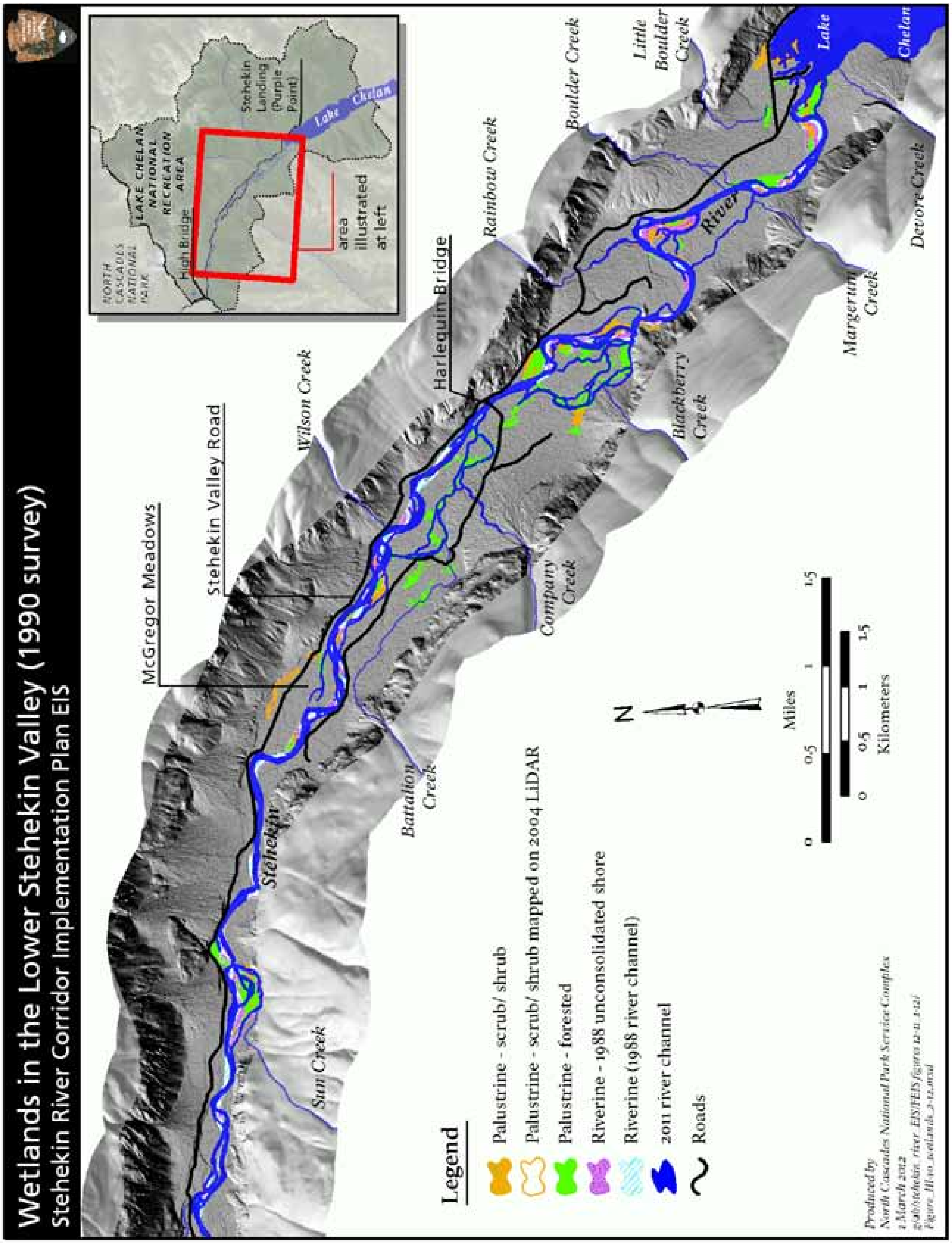
The NPS includes as wetlands those areas that have at least one of the following characteristics: hydrophytic soil types, hydrophytic vegetation, and/or hydrology (wet soil characteristics, wetland-dependent vegetation, and/or the presence of water). Wetlands within Lake Chelan NRA were classified according to the system developed by the United States Fish and Wildlife Service (USFWS) (Cowardin et al. 1979). These wetlands are first characterized by what kind of water they are associated with and then by the type of vegetation or substrate. Recreation area wetlands fall into one of three categories: palustrine (wet vegetated areas), riverine (river or stream channels), or lacustrine (associated with a lake).

Palustrine wetlands are those freshwater areas not associated with lakes, but rather with persistent groundwater. Palustrine wetlands include all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. Palustrine wetlands include those areas called marshes, bogs, fens, and prairies as well as shallow permanent or intermittent ponds. Palustrine wetlands are further classified as forested, emergent wetland persistent, and scrub-shrub wetlands (Cowardin et al. 1979).

Based on the GMP (NPS LACH 1995a:178), within the Stehekin Valley, palustrine wetlands cover approximately 164 acres, most (139 acres) of which is forested wetland, and the rest (25 acres), scrub-shrub wetland. These areas may shift rapidly during flooding, depending on the erosive forces of the Stehekin River as the river changes course within its channel migration zone.

Riverine wetlands include all wetlands and deepwater habitats contained within a channel, except for wetlands dominated by trees, shrubs, persistent emergent plants, emergent mosses,

**Figure III-10: Wetlands in the Lower Stehekin Valley (1990 survey)**



or lichens and those near saltwater. Water is usually, but not always, flowing in the channel and these wetlands may also be surrounded on their floodplain by other kinds of palustrine wetlands (Cowardin et al. 1979).

Based on the GMP (NPS LACH 1995a:178), within the Stehekin Valley, riverine wetlands are comprised of unconsolidated shore (88 acres) and open-water riverine habitat (167 acres). Similar to the palustrine wetlands, riverine wetlands change depending on the location of the Stehekin River and its associated side channels and tributaries.

Of the Weaver Point palustrine forested wetlands mapped in 1988 (8.7 acres), approximately half an acre have been destroyed by the river (in 2006).

Major wetlands within the project area include shoreline areas along the Stehekin River and the open-water channel of the Stehekin River, where some proposed actions, such as the installation of rock barbs, may occur. Most wetlands within Lake Chelan NRA remain undisturbed; however, according to the GMP, about 11 acres are affected by development (excluding roads). At the time of the GMP, there were eight private and two NPS buildings located within wetlands. A portion of the Stehekin Valley Road is also within wetlands (near McGregor Meadows) and a portion of the Company Creek Road (near the NPS Maintenance Area) is also located within a wetland.

The following wetlands are located in or near the proposed project area:

- Company Creek;
- McGregor Meadows
- Across from Former Skinny Wilson Homestead;
- Lower Field; and
- Coon Run (outside the project area).

**Company Creek:** The Company Creek wetlands extend upvalley from where Battalion Creek meets the valley floor to the confluence with Company Creek. The entire area is a matrix of beaver ponds damming side channels from both Battalion Creek and the Stehekin River. Using aerial photography from both February 2004 (leaf-off) and July 2006 (leaf-on), the palustrine-forested wetlands in this area are estimated to be approximately 101 acres.

**McGregor Meadows:** McGregor Meadows is a former agriculture site located between the Stehekin Valley Road and the river. A 5.5-acre clearing is surrounded by a mixed conifer-deciduous stand. The meadow and its surrounding forest lie at a low elevation within the channel migration zone of the Stehekin River. Changes in the channel caused by the recent large floods have increased the rate of conversion from upland to wetland and riverine habitats. For example, in 1993, just over three acres of palustrine forested wetlands were mapped within McGregor Meadows. An additional 0.75 acres were classified as scrub-shrub palustrine wetlands and approximately seven acres as riverine, unconsolidated shoreline. Much has changed in the intervening years. Flooding in 2003 and 2006 has left substantial accretions of rock over the forested upper part of the greater McGregor Meadows, and has scoured much of the meadows themselves, as well as the Stehekin Valley Road and portions of the low-lying areas inland of the road. A large logjam has formed at the head of No Name Creek (actually a side channel of the river). The GMP did not include the length of No Name Creek in its palustrine-forested habitat. July 2007 (leaf-on) and February 2004 (leaf-off) imagery shows that there is approximately

8.7 acres of this habitat along the creek. The logjam has contributed another 1.9 acres to the wetlands. The scrub-shrub wetland habitat has been washed away, and the river occupies what was unconsolidated shoreline in 1988 (NPS LACH 1995f).

On the opposite side of the road from the river, there is another wetland not captured in the 1993 inventory. This wetland is at the base of the hill and likely occupies an old river channel. A recent FHWA survey identified this as a palustrine scrub-shrub wetland, with an overstory of deciduous trees and red osier dogwood. The wetland covers about four acres, and ranges in width from 50 to 80 feet. It is fed by groundwater from the hillslope above, as well as by two surface streams and flood water from the river during peak flow events. This wetland would be affected by the Reroute Access Connector in Alternative 5.

**Coon Run:** The 11-acre Coon Run wetland follows Coon Creek down an ancient river channel of the Stehekin River. The wetland is fed by Coon Creek, surface and groundwater drainage from the lower slopes of McGregor Mountain, and by flood backwater at its lower end. A lack of drainage under the Stehekin Valley Road has increased water levels in the wetland. Deposition of gravel in the main channel of the river during the 2003 flood has also raised water levels in the lower part of the wetland throughout the year.

## 7. Vegetation

North Cascades vegetation is diverse, with over 1,627 plant species identified. Differences in vegetation types are attributed to rock and soil types, exposure (aspect), slope, elevation, and rainfall/precipitation.

Approximately 2,543 acres within the Stehekin Valley (below the 1,640-foot wilderness boundary elevation contour) was classified by Tanimoto (1991, with revisions by NPS in 1992) into 36 different vegetation cover types associated with five different soil moisture / nutrient condition categories (NPS LACH 1995a:183) (Figure III-11: *Lower Stehekin Valley Vegetation*).

The five soil moisture / nutrient condition categories are:

- Riparian—Nutrient Poor;
- Riparian—Nutrient Rich;
- Upland Mesic (moderate moisture);
- Upland Xeric (dry); and
- Miscellaneous.

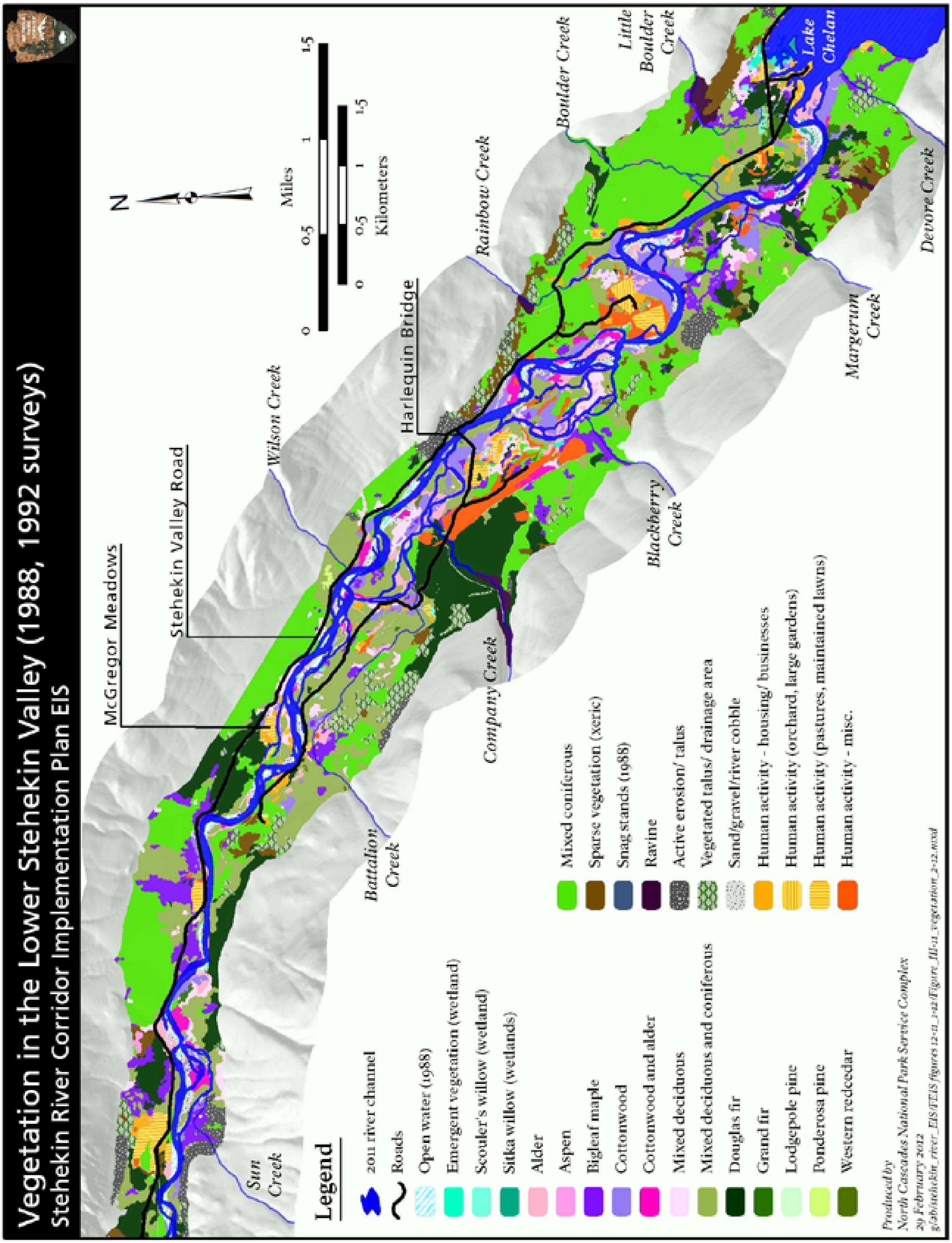
The 36 vegetation cover types are listed below according to these moisture/nutrient categories.

Overall, the riparian zone comprises 936 acres, or 36 percent, of the Stehekin Valley.

**Riparian—Nutrient Poor** is characterized by red alder/black cottonwood cover types, including those dominated by the following species:

- Red alder (*Alnus rubra*);
- Sitka willow (*Salix sitchensis*);

## Figure III-11: Lower Stehekin Valley Vegetation



- Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*); and
- Alder / cottonwood mixed stands.

These vegetation types are comprised of invading woody species on recent river deposits, mostly along the margins and floodplain of the Stehekin River and its tributaries.

**Riparian—Nutrient Rich** is characterized by the following dominant species: grand fir (*Abies grandis*), western red cedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*), bigleaf maple (*Acer macrophyllum*), black cottonwood, red alder, quaking aspen (*Populus tremuloides*), Scouler's willow (*Salix scouleriana*), and wetland emergent areas dominated by sedges. It contains the following:

- Mixed deciduous forest;
- Mixed coniferous forest; and
- Mixed deciduous coniferous forest.

Mixed deciduous forest stands contain bigleaf maple in addition to alder and cottonwood and are found on older river terraces. These and other riparian-nutrient rich communities are found where soils have become enriched from silt deposits and accumulation of leaf litter from earlier successional trees. Mixed coniferous forest is found on well-developed soils on old gravel bars. Mixed deciduous/coniferous forest is widespread throughout the valley and comprises the third most common vegetation cover type in the Stehekin Valley.

Relatively small, mostly pure stands of the following vegetation cover types are also part of the riparian-nutrient rich community:

- Grand fir (found near the mouth of the Stehekin River in moist sites with rich soil);
- Western red cedar (rare, comprising only nine acres, but found on wet sites associated with the river and its tributaries);
- Douglas-fir (occurs as a climax species on the oldest parts of point bars);
- Bigleaf maple (occurs throughout the riparian zone in a wide variety of site conditions);
- Cottonwood (in the nutrient-rich version of this habitat, cottonwood is mixed with bigleaf maple, grand fir, Douglas-fir, or red cedar-cottonwood stands and comprise a common sight, with 114 acres);
- Cottonwood/alder (in the nutrient-rich version of this cover type, these stands often contain bigleaf maple);
- Alder (in the nutrient-rich version of this cover type, alder forms distinct stands within old river channels and oxbows, especially near Company Creek Road);
- Aspen (uncommon; found only near Margerum Creek, possibly because of fire);
- Scouler's willow (pure stands occur near the mouth of the river on well-developed soils); and
- Emergent vegetation (primarily grass or sedge-dominated stands at the head of the lake associated with the drawdown of the reservoir).

**Upland Mesic** cover is characterized by nonriparian communities on soils of moderate moisture content. Dominant species include grand fir, Douglas-fir, black cottonwood, bigleaf maple, and ponderosa pine (*Pinus ponderosa*). Upland mesic includes the following vegetation cover types:

- Mixed deciduous forest (an uncommon class comprised of bigleaf maple mixed with cottonwood, vine maple, Scouler's willow, or Pacific dogwood);
- Mixed coniferous forest (the most common vegetation cover type, comprising 501 acres; dominated by Douglas-fir but also containing ponderosa pine or grand fir);
- Mixed deciduous coniferous forest (the fourth largest vegetation cover type comprised of a wide variety of already named deciduous and coniferous species);
- Grand fir (pure stands of non-riparian grand fir are very rare);
- Douglas-fir (pure stands, comprising 236 acres, comprise the second most common vegetation cover type);
- Ponderosa pine (tolerates drier sites on both sides of the valley);
- Bigleaf maple (common on well-developed, well-drained slopes, with an understory of Scouler's willow and Pacific dogwood);
- Cottonwood (rare on river deposits associated with tributaries); and
- Ravine (steep-sided tributary canyons with flowing streams and shallow soil, dominated by red cedar and other species).

**Upland Xeric** is relatively common and is found on the valley's steepest slopes and driest sites on either north- or south-facing slopes, including the following:

- Xeric uplands (largely unvegetated due to severe microclimates, characterized by exposed bedrock with little tree cover and little or no soil development);
- Active erosion/talus (largely unvegetated except for lichens, where present, due to severe microclimates); and
- Slope or talus drainage area (found at the base of active erosion and talus areas, supporting some sparse herbaceous plants and trees).

**Miscellaneous** cover types include the active river channel and areas of human disturbance, including the following:

- Sand/gravel/cobble (common in areas adjacent to the river);
- Water (Stehekin River wet channel and Lake Chelan);
- Lawn/pasture;
- Orchard/large garden (Buckner Homestead hayfield and pasture and large private gardens);
- Development/structures (residential, commercial, and public development, including buildings and other structures);

- Disturbed areas (tree cover of less than ten percent and lawn or other clearing or ample evidence of human disturbance); and
- Roads (estimated at 56 acres below High Bridge within the project area).

Dominant tree species within the Stehekin Valley are noted above. In native cover types, understory species consist of a variety of shrubs and small trees, including vine maple (*Acer circinatum*), serviceberry (*Amelanchier alnifolia*), dogbane (*Apocynum ansrosaemifolium*), snowberry (*Symphoricarpus albus*), oceanspray (*Holodiscus discolor*), snowbush (*Ceanothus velutinus*), mahonia or Oregon grape (*Berberis aquifolium*), red-flowering currant (*Ribes sanguineum*), wild roses (*Rosa* spp.), Pacific dogwood (*Cornus nuttalli*), boxwood (*Paxistima myrsinites*), and bearberry or pinemat (*Arctostaphylos nevadadensis* or *A. uva-ursi*). Common forbs include big-leaf sandwort (*Moehringia macrophylla*) and Watson's willow-herb (*Epilobium watsonii*). Grasses include pine grass (*Calamagrostis rubescens*), Ross's sedge (*Carex rossii*), western fescue (*Festuca occidentalis*), onion grass (*Melica subulata*), and Lemmon's needle grass (*Achnatherum lemmonii*). Sword fern (*Polystichum imbricans*) is also a common understory plant.

The most diverse vegetation is found within the riparian zone, an area characterized by its proximity to active river or stream channels where vegetation communities are influenced by high water tables, flooding, and the ability of the soil to hold water (Naiman et al. 1993 in NPS LACH 1995a:181). This zone of influence between the abundant moisture and the higher, drier terraces above it is important to both plants and wildlife and, in fact, is characterized by species from wide geographical, altitudinal, and ecological ranges (Mason and Koon 1985). Studies have found that nearly 70 percent of vertebrates in a region use riparian corridors during their life cycle (Naiman et al. 1993 in NPS LACH 1995a:181). Riparian areas provide a means of transfer for water, nutrients, sediment, organic matter, and aquatic and terrestrial organisms between this area and the drier montane or forested areas above it (Gregory et al. 1991 in NPS LACH 1995a:181).

Other vegetation classes that were identified as being the most important / sensitive to the Stehekin ecosystem are the open water, upland xeric, and active erosion/talus areas (NPS LACH 1995a:184). These areas provide unique habitats for waterfowl, major vertebrates, and reptiles and amphibians, respectively.

## Fungi

The Stehekin watershed is unique for its numerous fungi species. Between April 2005 and 2006, fungi inventories led by emeritus professor James Trappe of the University of Oregon have yielded 480 collections of macrofungi in the Stehekin watershed, of which three species are new to science and two are extremely rare (NPS 2007a:3).

## Changes to Native Plant Community Cover

Among the human activities which have affected the vegetation composition within the Stehekin Valley include logging, wildfire management (Forest Fuel Reduction Areas) and suppression, and farming. Some areas, including McGregor Meadows (Mileposts 6.5 - 7.0) and the Stehekin Valley Ranch (Milepost 9.0), where concentrated development, farming, and/or ranching activities altered vegetation, have not recovered their native plant community composition, even where that activity is no longer occurring. Others are dominated by nonnative, ornamental, or weedy species.

## Nonnative Plants and Noxious Weeds

Nonnative plants and noxious weeds are found within disturbed areas of the Stehekin Valley. These areas primarily include road edges, areas near NPS and private development, borrow areas such as the gravel pit, the Buckner Homestead hayfield and pasture, and the airstrip as well as areas that recently burned in the Flick Creek and Rainbow fires.

Among the plants found include: diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea maculosa*), mullein (*Verbascum thapsus*), Japanese knotweed (*Polygonum cuspidatum*), oxeye daisy (*Leucanthemum vulgare*), Dalmatian toadflax (*Linearia genistifolia dalmatic*), rush skeletonweed (*Chondrilla juncea*), Scotch broom (*Cytisus scoparius*), baby's breath (*Gypsophila paniculata*), Himalayan blackberry (*Rubus discolor*), tansy ragwort (*Senecio jacobea*), yellow salsify (*Tragopogon dubius*), bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*), sweet pea (*Lathyrus odoratus*), vinca (*Vinca minor*), white clover (*Trifolium repens*), rush skeletonweed (*Chondrilla juncea*), sheep sorrel (*Rumex acetosella*), sow thistle (*Sonchus asper*), and foxglove (*Digitalis purpurea*), as well as a variety of nonnative grasses, including bulbous bluegrass (*Poa bulbosa*), cheatgrass (*Bromus tectorum*), and orchard grass (*Dactylis glomerata*).

An unknown number of acres within the Stehekin Valley are affected by nonnative plants or noxious weeds. Control is focused on containing, reducing, and eliminating populations. Most actions in recent years have been undertaken in the following areas: the Stehekin airstrip, the edges of the Stehekin Valley Road, and spot locations throughout the lower valley that had previously been heavily infested with knapweed.

## Vegetation Characteristics of Areas Potentially Affected by the Alternatives

Vascular plant surveys of potential properties, road alignments, and campsite locations in conjunction with activities associated with the SRCIP were conducted June 19 and July 8 - 9, 2008. The surveys were conducted by North Cascades NPS Complex, Mignonne Bivin, Botanist, and William Clark, seasonal vegetation biological technician.

### *Exchange Properties within the Project Area (Alternative 1)*

- Vicinity of Lower Field;
- Little Boulder / Boulder Creek (both sides of the road);
- East of the airstrip;
- Vicinity of Stehekin Valley Ranch; and
- Above Rainbow Creek (west side of the road).

### *Potential Exchange Property Characteristics within the Project Area (Alternatives 2 - 5)*

As shown in Table III-7: *Potential Exchange Property Characteristics*, 12 formerly privately owned parcels now owned by NPS have been identified for potential land exchange. Each of the parcels was surveyed by (1) walking the parcel in such a manner so as to ensure that all habitats were surveyed and (2) completely surveying any potential sensitive plant species habitat (intuitive sampling).

Within the proposed project area, there are five areas identified for location or relocation of recreational development. These include: Company Creek potential group site, Purple Point Horse Camp group/individual sites, Rainbow Falls, Bullion, and an area near the mouth of the Stehekin River (Table III-8: *Potential Recreational Development Sites*).

In addition to these potential land exchange parcels and potential recreational development sites, proposed road realignment within the project area would primarily occur within the upland mesic vegetation type and include areas dominated by Douglas-fir, ponderosa pine, bigleaf maple, and western red cedar; however, a portion of it would also occur in the pasture vegetation type and in talus.

**Table III-7: Potential Exchange Property Characteristics**

| Area | Former Private Owner / Parcel Number(s) | Vegetation Composition | Notes |
|---|---|---|---|
| Boulder Fan area | Griffin (05-115, 05-116, 05-118) | Dominated by ponderosa pine / Douglas-fir. Sparse to moderate understory of xeric to mesic species. | |
| Boulder Fan area | Getty (05-156) | | |
| Keller's Park / Boulder Fan area | Dineen (05-114) | | |
| School area | Rice (05-106) | Dominated by dense Douglas-fir with very little understory. | One large parcel shown as two separate ones of 1.68 acres and 2.73 acres |
| Castle / Keller Park: Corral area near the bakery | Brownfield (part of 05-122) | Douglas fir with occasional ponderosa pines with moderate cover of shrubs and herbaceous plants. | |
| Airstrip area | Peterson (06-110) | Cleared of most trees. Dominated by introduced grasses with a few ponderosa pine, Douglas-fir, and bigleaf maple. | |
| Orchard | Webb (06-107, 06-108) | Outside wetland. Consists of widely spaced ponderosa pine and Douglas-fir with sparse understory (treated for fuel reduction). | 1.33 acres |
| Lower Field / Stehekin Valley Ranch | Courtney (08-104) | Xeric Douglas-fir / ponderosa pine. Riparian edge along Stehekin River, dominated by bigleaf maple, dogwood, cottonwood, western red cedar, and red alder. Diverse understory, occasionally dense. | This area increased by five acres in Alternative 5. |

**Table III-8: Potential Recreational Development Sites**

| Area | Vegetation Composition | Notes |
|---|---|---|
| Company Creek Area | Open Douglas-fir forest. Disturbed understory with many nonnative, invasive species. | Potential campsite(s). |
| Purple Point Horse Camp Area | Comprised of FMP manipulated Douglas-fir and ponderosa pine. Sparse understory. | Fire Management Plan (FMP) identified wildland-urban interface. Potential campsite(s). |
| Rainbow Falls Area | Douglas-fir / ponderosa pine overstory and sparse understory of herbaceous shrubs and plants. | Potential campsite(s). |
| Bullion Camp Area | Douglas-fir / ponderosa pine forest with sparse understory of herbs and drought-tolerant shrubs. | Across Stehekin Valley Road south of current camp (near the Stehekin River). Potential campsite(s). |
| River Resort Road | Dense cover of grand fir and Western red cedar across the road from this site. The understory cover was very sparse throughout most of the site. Wetland depressions with standing water and obligate wetland plant species occur throughout the parcel but not within the area of the river access point. | Potential river access point. |

## 8. Fish and Wildlife

Wildlife species inhabiting the Stehekin Valley include approximately 40 species of mammals, over 100 bird species, seven reptile species, and five species of amphibians. From summer 1988 through late winter 1992, as part of the Stehekin Valley vertebrate inventory, the following numbers of species were detected: five amphibians, eight reptiles, 25 mammals, and 104 birds (Kuntz and Glesne 1993).

### Terrestrial Mammals

Mammals found within the Stehekin Valley include black bear (*Ursus americanus*), elk (*Cervus elaphus*), mountain goat (*Oreamnos americanus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), northern flying squirrel (*Glaucomys sabrinus*), and snowshoe hare (*Lepus americanus*).

Small mammal species detected during the vertebrate inventory in live or pitfall traps included two kinds of mice (*Peromyscus maniculatus*, *P. oreas*); Trowbridge's, montane, and vagrant shrews (*Sorex trowbridgei*, *S. monticolus*, and *S. vagrans*); shrew-mole (*Neurotrichus gibbsii*); creeping vole (*Microtus oregoni*); Gapper's red-backed vole (*Clethrionomys gapperi*); bushy-tailed woodrat (*Neotoma cinerea*); Douglas's squirrel (T*amiasciurus douglasii*); Townsend's chipmunk (*Eutamias townsendii*); yellow-pine chipmunk (*Eutamias amoenus*); western gray squirrel (*Sciurus griseus*); and Cascades golden-mantled ground squirrel (*Spermophilus saturatus*). Of these, the shrews were most abundant and were captured in all habitat classes (Kuntz and Glesne 1993:17 - 20).

In addition, the following large and medium-sized mammals were detected during the inventory: black bear, raccoon, beaver (*Castor canadensis*), marten (*Martes americana*), mountain lion (*Felis concolor*), elk (*Cervus elaphus*), moose (*Alces alces*), and mule deer (*Odocoileus hemionus*) (Kuntz and Glesne 1993:35).

## Bats

Little is known about bat populations in the Stehekin Valley. Riparian areas and open meadows are important foraging areas for bats. Area bats may use former mines, caves, and tree or rock crevices for roosting and rearing.

Park biologists conducted a systematic baseline inventory during the summers from 1998 to 2001 to identify species composition, distribution, and relative abundance of bats inhabiting North Cascades NPS Complex. Sampling sites included riparian, forest, and subalpine areas, both east and west of the North Cascades crest. Five species were identified from capture techniques: Yuma myotis (*Myotis yumanensis*), little brown myotis (*Myotis lucifugus*), western long-eared myotis (*Myotis evotis*), California myotis (*Myotis californicus*), and long-legged myotis (*Myotis volans*), all of which showed evidence of breeding (Christopherson and Kuntz 2003). An additional three species were documented from acoustic recordings: big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*) (Christopherson and Kuntz 2003). Both acoustic and capture data suggest the Yuma myotis and little brown myotis are the most abundant species in the study area, while the hoary bat and long-legged myotis appear to be the most uncommon or elusive of the documented bat species in North Cascades NPS Complex (Christopherson and Kuntz 2003). From other sampling sites, all of the above capture- and acoustic-detected species were documented except the hoary bat (Christopherson pers. comm. 2009).

Other bats expected but not found during this survey include the following species: western small-footed myotis (*Myotis ciliolabrum*), Keen's myotis (*Myotis keenii*), fringed myotis (*Myotis thysanodes*), and western red bat (*Lasiurus blossevillii*) (Johnson and Cassidy 1997).

Photo 17 – Black bear fishing for spawning kokanee salmon (Dick Bingham).

## Birds

Among the more than 100 species of birds that can be found in the Stehekin Valley are the pileated woodpecker, gray jay, dark-eyed junco, black-capped chickadee, sooty grouse, common raven, red-tailed hawk, and American kestrel. The predominant bird species detected during the Stehekin Valley vertebrate inventory (Kuntz and Glesne 1993) were Hammond's flycatcher, Swainson's thrush, American robin, red-eyed vireo, yellow-rumped warbler, MacGillivray's warbler, western tanager, and dark-eyed junco. These species accounted for 50 percent of the detections and were present across all habitat classes sampled (Kuntz and Glesne 1993:11). In winter counts, 25 species were detected, with wintering waterfowl predominating (nine species comprising nearly half the detections), followed by pine siskin, evening grosbeak, chestnut-backed chickadee, red-breasted nuthatch, and golden-crowned kinglet. Wintering waterfowl included horned grebe, Canada goose, mallard, American widgeon, ring-necked duck, common goldeneye, Barrow's goldeneye, bufflehead, and common merganser.

Brown-headed cowbirds are found in the Stehekin Valley and appear to be increasing in abundance (Kuntz pers. comm. 2009). Brown-headed cowbirds are brood parasites, laying their eggs in other songbird nests. The cowbird young outcompete their host species young for food brought to the nest by the host species parents. Cowbird young survive to fledging, while most or all of the host species' young die of starvation or are pushed out of the nest by the bigger cowbird young. Cowbirds have increased in the Pacific Northwest due to logging of forests and land conversion to agricultural uses. In Stehekin, community land development and the presence of livestock (horses) have enabled cowbirds to increase in number. Cowbirds in the valley have been documented parasitizing yellow-rumped warbler nests (Kuntz pers. comm. 2009).

## Reptiles and Amphibians

Common reptiles include the common garter snake (*Thamnophis sirtalis*), western terrestrial garter snake (*Thamnophis elegans*), and the northern alligator lizard (*Gerhonotus coeruleus*). Amphibians include the northwestern salamander (*Ambystoma gracile*), rough-skinned newt (*Taricha ganulose*), Columbia spotted frog (*Rana luteiventris*), Cascades frog (*Rana cascadae*), and western toad (*Bufo boreas*).

In the vertebrate inventory the following reptiles were detected: western terrestrial garter snake, common garter snake racer (*Coluber constrictor*), rubber boa (*Charina bottae*), northern alligator lizard (*Elgaria coeruleus*), western fence lizard (*Sceloporous occidentalis*), and western rattlesnake (*Crotalus viridis*); and the following amphibians were detected: long-toed salamander, western toad, Pacific tree frog, Cascades frog, and spotted frog (*Rana pretiosa*) (Kuntz and Glesne 1993:10). Most reptiles in pitfall traps were captured in the upland mesic habitat type. Of these, western fence lizards were the most common species. Talus areas, though they comprised only 2.6 percent of the area studied, were important for their reptilian species diversity (Kuntz and Glesne 1993:10).

## Fish

(For more information on the status of both native and nonnative fish, see the North Cascades National Park Service Complete Mountain Lakes Fishery Management Plan EIS (NPS NOCA 2008b).)

Large woody debris in the form of individual pieces and log jams is an important component of the Stehekin River for fish, amphibians, and aquatic invertebrates. The abundance of fish in streams and rivers is strongly related to the abundance of coarse woody debris. Woody debris within the river channel provides cover for fish, and creates pools and backwater areas, storing sediment and capturing gravel for spawning (NPS LACH 1995a:175; Sedell et al. 1984 in NPS LACH 1995a).

Lake Chelan, the Stehekin River, and its tributaries provide valuable spawning, incubation, rearing, and feeding habitat for a variety of fish species, including six native and 12 nonnative trout and salmon species. Nonnative species known to occur in the Stehekin River or its tributaries include kokanee salmon (nonnative, landlocked sockeye salmon) (*Oncorhynchus nerka*), Chinook salmon (*O. tshawytscha*); and brown (*Salmo trutta*), brook (*Salvelinus fontinalis*), lake (*S. namaycush*), golden (*O. mykiss aguabonita*), and rainbow trout (*O. mykiss*). Nonnative species compete with and prey on native species.

Most nonnative fish were introduced by the Washington Department of Wildlife and Washington Department of Fisheries (later the Washington Department of Fish and Wildlife (WDFW). Kokanee were stocked beginning in 1917 and became the dominant sport fish until the mid-1970s. They can be found in the fall, spawning in tributaries of the Stehekin River, such as Company and Blackberry creeks. Chinook were introduced to Lake Chelan to provide a trophy fishery. Rainbow, brook, and golden trout were introduced to previously fishless high mountain lakes. Lake trout were introduced to Lake Chelan between 1980 and 1982.

Native species include bull trout (*Salvelinus confluentus*), dolly varden (*Salvelinus malma*), and westslope cutthroat trout (*Oncorhynchus clarki lewisi*). Although there have been numerous surveys for bull trout, none have been found in the Stehekin or its tributaries for the last 50 years (see also "Special Status Species" section below for more information on bull trout, dolly varden, and westslope cutthroat trout). Bull trout are considered extirpated from the Stehekin River since none have been found since the early 1960s. The USFWS, however, is considering their reintroduction (NPS LACH 2008:173). Dolly varden have not been documented in the Stehekin River. Nonhybridized cutthroat trout occur above High Bridge, outside the project area. Below that area, they mix with nonnative rainbow trout.

It is unlikely that there were ever many anadromous fish (fish that spend most of their life cycle in saltwater but breed in freshwater) in the Chelan Subbasin (USDC draft 2004 in NPS NOCA 2006c). Studies in the late 1800s and archeological documentation of fish use by prehistoric people have uncovered very little evidence of anadromous fish. In addition, a series of chutes, cascades, and falls in the Chelan River on its way to the Columbia River are barriers to anadromous fish migration (USDC draft 2004 in NPS NOCA 2006c).

## Invertebrates

Recent surveys of butterflies in Stehekin have documented 30 species (David Droppers pers. comm. with R. Kuntz 4-18-08). The most common species include woodland skipper (*Ochlodes sylvanoides*), western tiger swallowtail (*Papilio rutulus*), pale swallowtail (*Papilio eurymedon*), cabbage white (*Pieris rapae*), California tortoiseshell (*Nymphalis californica*), echo azure (*Celastrina echo*), and Lorquin's admiral (*Limenitis lorquini*).

# 9. Special Status Species

This section includes information on federally listed threatened and endangered species, state-listed or identified rare, threatened, and endangered species, and park-identified rare or sensitive species. Although sensitive species are not protected under the Endangered Species Act, NPS policy states that they will be managed similarly to federally listed species to the greatest extent possible.

## Special Status Plants

Each area potentially affected by the proposed alternatives was surveyed for sensitive plant species as identified by Washington State Department of Natural Resources and the USFWS. Ten species were identified as potentially occurring within the Stehekin area (Table III-9: *Special Status Plants*). No species listed by the USFWS as federally listed are known to occur in North Cascades NPS Complex. No sensitive plant species were observed in these surveys. All vascular plant species observed and their relative abundance for each site were recorded (Appendix 8: *Vascular Plants Observed within Proposed Project Areas*).

The small number of rare plants located in previous surveys is found outside of the project area. Rare plant surveys were conducted in spring 2008 on parcels that could be affected by actions associated with this planning effort (see “Vegetation” section).

## Special Status Fish and Wildlife

### *Grizzly Bear*

**Range:** According to the USFWS, the North Cascades contain habitat capable of supporting a self-sustaining population of grizzly bears (USFWS 2005 in NPS NOCA 2006c). Only a remnant population exists, which is unlikely to persist without recovery efforts. Although suitable habitat exists within the Stehekin Valley below High Bridge, grizzly bears have not been documented in the last ten years. In general, grizzlies are considered extremely rare in the North Cascades (NPS LACH 2007).

**Habitat:** Key habitat requirements for grizzly bears include the availability of a reliable food source and isolation from humans (USFWS 1989 in NPS NOCA 2006c). Grizzlies may use low-elevation riparian areas and wet meadows during spring, and higher-elevation meadows, ridges, and open shrublands during summer. Avalanche chutes are likely an important habitat component from spring through fall (McLellan and Hovey 2001; Ramcharita 2000).

**Recovery:** The *Grizzly Bear Recovery Plan for North Cascades Ecosystem* was approved in 1997 (USFWS 1997), but major portions of it have not been funded. In the interim, the NPS and USFS have agreed to no net loss of core areas in the North Cascades ecosystem. Under this agreement, construction of roads or high-use trails in a core area (more than 1,640 feet from roads or high-use trails) requires closure of a road and/or a trail of similar size, use level, and habitat within the affected Grizzly Bear Management Unit. The upper Stehekin River Grizzly Bear Management Unit is 95,000 acres.

**Table III-9: Special Status Plants**

*Potential Washington State Sensitive Plants from Stehekin Valley Surveys*

| Species | Common name | Habitat | State Status |
|---|---|---|---|
| *Astragalus arrectus* | Palouse milk vetch | Sagebrush flats, grassy hillsides, openings in Ponderosa Pine or Douglas fir forest gravelly or sandy flats. | Threatened |
| *Botrychium lunaria* | Common moonwort | Moist open areas in meadows and forests. | Watch |
| *Botrychium minganense* | moonwort | Moist sites in deciduous and coniferous forest, subalpine sites. A fern-like plant known from two places in the lower Stehekin Valley. | Watch |
| *Botrychium pedunculosum* | Stalked moonwort | Moist wooded sites. | Sensitive |
| *Cicuta bulbifera* | Bulb-bearing hemlock | Edges of marshes, lakes, bogs, meadows, and shallow standing or slow-moving water. | Sensitive |
| *Epipactis gigantea* | Giant hellebore | Streambanks, lake shores, seeps, springs. A nonshowy orchid found along streambanks, seeps, and lake margins known from undisturbed sites south of the Landing. | Watch |
| *Githopsis specularioides* | Common blue-cup | Dry, open places in foothill areas of thin soils, talus slopes. | Sensitive |
| *Pellaea brachyptera* | Sierra cliff brake | Dry, Rocky slopes, talus, outcrops in Douglas-fir and Ponderosa Pine forest. | Sensitive |
| *Penstemon eriantherus* var. *whitedii* | Fuzzy-tongued penstemon | Open sagebrush shrub, open areas in valleys and foothills. | Sensitive |
| *Spiranthes porrifolia* | Western ladies tresses | Meadows, seeps, streams. An orchid that blooms in July and August, found in moist to wet areas, known from a disturbed site south of the Landing. | Sensitive |

*Definitions:*
*State status is described as follows: Factors considered include abundance, occurrence patterns, vulnerability, threats, existing protection, and taxonomic distinctness. Values include:*
*Extinct or Extirpated: Possibly extinct or Extirpated from Washington.*
*Endangered: In danger of becoming extinct or extirpated from Washington.*
*Threatened: Likely to become Endangered in Washington.*
*Sensitive: Vulnerable or declining and could become Endangered or Threatened in the state.*
*P1 = Priority 1. Rare nonvascular plant but with insufficient information to assign another rank.*
*P2 = Priority 2. Nonvascular plant of concern but with insufficient information to assign another rank.*
*R1 = Review group 1. Of potential concern but needs more field work to assign another rank.*
*R2 = Review group 2. Of potential concern but with unresolved taxonomic questions.*
*Watch: More abundant and/or less threatened than previously thought.*

**Table III-10: Special Status Wildlife**

| Species | Federal Status* | State Status* | Park Status / Notes (See also information below this table.) |
|---|---|---|---|
| Mammals | | | |
| Gray wolf (*Canis lupus*) | FE | SE | |
| Canada lynx (*Lynx canadensis*) | FT | ST | Lynx critical habitat is designated in Chelan County east of the Cascade Crest and above the 4,000 ft contour interval (outside the proposed project area) |
| Grizzly bear (*Ursus arctos horribilis*) | FT** | SE | All of the project area is within the North Cascades Grizzly Bear Recovery Area |
| California wolverine (*Gulo gulo luteus*) | FSC | SC | |
| Pacific fisher (*Martes pennanti pacifica*) | FC | SE | |
| Western gray squirrel (*Sciurus griseus*) | FSC | ST | |
| Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*) | FSC | SC | |
| Small-footed (Yuma) myotis (*Myotis ciliolabrum*) | FSC | | |
| Western long-eared myotis (*Myotis evotis*) | FSC | SM | |
| Fringed myotis (*Myotis thysanodes*) | FSC | SM | |
| Long-legged myotis (*Myotis volans*) | FSC | SM | |
| Keen's myotis (*Myotis keenii*) (coastal species that does not occur in Lake Chelan NRA) | | SC | |
| Birds | | | |
| Bald eagle (*Haliaeetus leucocephalus*) | FSC (M) | SS | A pair has nested near the mouth of the Stehekin since 2001 |
| Northern spotted owl (S*trix occidentalis caurina*) | FT | SE | |
| Peregrine falcon (*Falco peregrinus anatum*) | FSC (M) | SS | |
| Golden eagle (*Aquila chrysaetos*) | | SC | |
| Merlin (*Falco columbarius*) | | SC | |
| Northern goshawk (*Accipiter gentilis*) | FSC | SC | |
| Olive-sided flycatcher (*Contopus cooperi*) | FSC | | |
| Harlequin duck (*Histrionicus histrionicus*) | | SC | |
| Black swift (*Cypseloides niger*) | FSC | | |
| Vaux's swift (*Chaetura vauxi*) | | SC | |
| Lewis's woodpecker (*Melanerpes lewis*) | | SC | |

| | | | |
|---|---|---|---|
| Black-backed woodpecker (*Picoides arcticus*) | | SC | |
| Pileated woodpecker (*Dryocopus pileatus*) | | SC | |
| Common loon (*Gavia immer*) | | SS | |
| Western grebe (*Aechmophorus occidentalis)* | | SC | |
| Reptiles | | | |
| (none) | | | |
| Amphibians | | | |
| Columbia spotted frog (*Rana luteiventris*) | FC | SC | |
| Western toad (*Bufo boreas*) | FSC | SC | |
| Spotted frog (*Rana pretiosa*) | FSC | SC | |
| Cascades frog (*Rana cascadae*) | FSC | | |
| Tailed frog (*Ascaphus truei*) | FSC | | |
| Fish | | | |
| Bull trout (*Salvelinus confluentus*) | FT | SC | |
| Dolly Varden (*Salvelinus malma*) | FP, SC | | |
| Chinook salmon (*Oncorhynchus tshawytscha*) | FT | SC | |
| Westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) | FSC | | |
| Invertebrates | | | |
| (none) | | | |

**Definitions*

*Federal (USFWS/ National Oceanic and Atmospheric Administration, National Marine Fisheries Service [NOAA Fisheries])*
*FE = Federally Endangered: Listed by the USFWS or NOAA Fisheries as a species that is in danger of extinction throughout all or a significant portion of its range.*
*FT = Federally Threatened: Listed by the USFWS or NOAA Fisheries as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.*
*FP = Federally Proposed: Species for which the USFWS or NOAA Fisheries has determined are warranted for listing and are proposed in the Federal Register listing as threatened or endangered but for which rules have not yet been promulgated.*
*FC = Federal Candidate: Species that are under consideration for listing by the USFWS or NOAA Fisheries but which do not yet have conclusive information to warrant listing as threatened or endangered.*
*FSC = Federal Species of Concern: Species whose conservation standing is of concern to the USFWS, but for which status information is still needed. These are generally species from the former Category I, II, or III lists.*
*(M) = Species that have been delisted but whose status is still monitored.*

*State (WDFW)*
*SE = Washington State Endangered: A species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state as listed by the WDFW.*
*ST = Washington State Threatened: A species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats as listed by WDFW.*
*SC = Washington State Candidate: Includes species that the WDFW is considering for possible listing as endangered, threatened, or sensitive. According to the WDFW, a species will be considered for designation as a state candidate if sufficient evidence suggests that its status may meet the state listing criteria defined for endangered, threatened, or sensitive.*
*SS = Washington State Sensitive: A species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened throughout a significant portion of its range within the state without cooperative management or removal of threats, as identified by WDFW.*
*SM = Washington State Monitor: A species native to the State of Washington that is of special interest because (1) at one time it was classified as endangered, threatened, or sensitive; (2) it requires habitat that has limited availability during some portion of its lifecycle; (3) it is an indicator of environmental quality, (4) further field investigations are required to determine population status; (5) there are unresolved taxonomic problems that may affect its classification status; (6) it is competing with or affecting other species of concern; or (7) it has significant popular appeal.*

*** The USFWS has determined that grizzly bears in the North Cascades Ecosystem are warranted for listing as Endangered under the Endangered Species Act, but that change in status remains precluded by other priorities.*

### *Gray Wolf*

**Range:** Wolves formerly ranged throughout the North Cascades, but were extirpated from many areas by 1910. In the last 20 years, wolves have been seen near Ross Lake, in the Pasayten Wilderness, in Okanogan National Forest, and in Glacier Peak Wilderness. Recolonization of wolves from Canada into Washington State is also occurring. Wolf packs require territories ranging from 40 to 1,000 square miles. Although essentially all of the Stehekin area is considered suitable habitat, winter deer range in the riparian zone and south-facing slopes of the lake may be particularly important.

Recent studies conducted by the North Cascades resource management biologist and biologists from the WDFW documented wolf presence in Lake Chelan NRA wilderness. Collared animals were tracked in the upper elevations of the wilderness area. The last sightings of gray wolves in the Stehekin Valley below High Bridge, however, were more than ten years ago.

**Habitat:** Gray wolves are highly social animals with large home ranges comprising a variety of terrain. Key habitat components include a sufficient year-round ungulate prey base coupled with the availability of other prey species (mid-sized mammals); suitable, fairly secluded denning and rendezvous sites; and minimal exposure to human activity (USFWS 1987 in NPS NOCA 2006c).

**Recovery:** There is currently no USFWS recovery plan for gray wolves in the North Cascades.

Photo 18 – Gray wolf pups (Conservation Northwest).

### *California Wolverine*

**Range:** Wolverines are an uncommon resident of a wide variety of vegetation types in remote mountainous areas. They occupy high-elevation coniferous forests and subalpine areas.

**Habitat:** In Washington, they are associated with subalpine and alpine areas, moving down to forested valleys in winter. They feed on ungulates and small mammals (Johnson and Cassidy 1997). Most evidence of wolverines from the North Cascades has been within the Bridge Creek drainage, including the observance of tracks on the Bridge Creek Bridge. Two unconfirmed wolverine sightings from January 1974 and June 1983 in the Stehekin Valley are in the wildlife observation database (NPS NOCA 2006c). Wolverines were not detected in the Vertebrate Inventory (Kuntz and Glesne 1993:24). Wolverines were also not detected in the Forest Carnivore Surveys (Happe et al. 2006).

The activity areas of three wolverines fitted with radio collars during 2006 - 2009 include all of the lower Stehekin Valley. How much time these individuals spent within the lower valley, however, is not known (USFS 2009). In the winter of 2010-11, a Stehekin resident photographed a wolverine with a movement-sensing camera set up roughly halfway between the head of the lake and High Bridge.

**Recovery:** Since wolverines are not yet federally listed, no recovery plan has been established for this species.

### *Canada Lynx*

**Range:** Although lynx are documented as occurring in the North Cascades, it is likely that lynx were uncommon visitors to the Stehekin River valley due to its lower elevation and a lack of available primary habitat (spruce-fir forest). Four unconfirmed sightings of lynx in the lower Stehekin Valley (below High Bridge) were documented between 1975 and 2000. A small number of lynx live in the Pasayten Wilderness east of Ross Lake (NPS LACH 2007).

Photo 19 – California wolverine.

**Habitat:** Lynx are associated with subalpine and boreal forests throughout their range (Witmer et al. 1998; Aubry et al. 1999). The species requires a mosaic of forest seral stages connected by stands suitable for travel cover. Lynx use late-seral forests for denning and rearing young and use early seral forests for foraging (Aubry et al. 1999). Primary prey is snowshoe hare, although lynx will take other prey, particularly when hare density declines.

A vertebrate inventory conducted in 1990 and 1991 documented snowshoe hare presence in the Stehekin Valley (Kuntz and Glesne 1993). Lynx tend to use higher-elevation habitat (3,000 - 4,000 feet) than the Stehekin Valley. In addition, that habitat is often comprised of lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*), species generally absent from the lower Stehekin Valley. Lynx have not been reported from the Stehekin Valley since 1980. Lynx were not detected in the Forest Carnivore Surveys (Happe et al. 2006).

### *Pacific Fisher*

**Range:** Fishers formerly occurred throughout densely forested areas of Washington State. Records of fishers in the eastern North Cascades are associated with forests above 1,800 feet containing Douglas-fir and grand fir. Extensive surveys have been unable to confirm the existence of a population in the state (NPS LACH 2007). However, a reintroduction effort to restore fishers to Olympic National Park is currently underway as part of an effort to reestablish self-sustaining fisher populations in the state.

**Habitat:** Fishers are associated with riparian areas in late successional coniferous forests (Ruggiero et al. 1994 in NPS 2006a). Large snags and logs provide denning and nesting sites. Fishers also use a wide variety of forested areas for foraging. Riparian areas, lakeshores, and ridgelines are used as movement corridors. Although the North Cascades area around Stehekin at one time had the highest density of recent fisher records in the state (10 records between 1980 and 1991) (NPS LACH 1995a:194), fishers have not been documented in the Stehekin Valley since 1980 (Christopherson and Kuntz 2004; DES 2000 in NPS 2006a; Kuntz and Glesne 1993:24). Fishers were also not detected in the Forest Carnivore Surveys (Happe et al. 2006).

**Recovery:** Since fishers are not yet federally listed, no recovery plan has been established for this species.

### *Western Gray Squirrel*

**Range:** Although western gray squirrels are common in California and Oregon, where oak trees are common, park researchers are uncertain how the population persists in Stehekin Valley, where there are no oaks. The western gray squirrel population in Washington is believed to be declining. There are only three isolated populations in the state, including a very small population in the Stehekin Valley. The state's review of the Stehekin population concluded that the Stehekin population is highly vulnerable and may not survive without active management based on limited availability of analysis of populations and trends.

**Habitat:** Western gray squirrels prefer mixed oak and conifer forests. In areas without oaks, such as the Stehekin Valley, ponderosa pine and Douglas-fir are used. Stehekin Valley forests provide squirrels with conifer seeds, mushrooms, insects, berries, and canopies for nesting. Trees provide either seasonal or year-round cover, nest sites, travel corridors, and food. A small population of western gray squirrels occurs in the Stehekin Valley, where they were documented in the nutrient-rich conifer and upland mesic conifer habitat classes (Kuntz and Glesne 1993:24). Park researchers know little about the gray squirrels' habitat requirements in the Stehekin Valley and it is unknown whether, over the long term, they can continue to persist.

**Recovery:** Their small, isolated populations, sensitivity to habitat change, and low reproductive rates (one litter per year) make them susceptible to extinction. In partnership with the University of Washington and the USGS, park biologists hope to learn more about the squirrels through a three year study (which began in fall 2007). Researchers captured and attached radio-collars to approximately 16 squirrels to assess vital demographic rates and habitat requirements on western gray squirrel populations in Stehekin. The study will also try to determine how current recreation area management and private landowners' actions impact the western gray squirrel population in the Stehekin Valley. Suggested management actions to maintain a viable population of western gray squirrels in Stehekin Valley include maintaining islands of trees (particularly conifers) with close or touching canopies as transportation corridors for the squirrels. The squirrels prefer to nest in mistletoe brooms of conifers; therefore it is important to retain trees with mistletoe brooms high in the canopy (NPS 2007:4, Stuart pers. comm. 2011).

### *Bats*

The Stehekin Valley contains habitat or potential habitat for four bat species that are considered federal species of concern: the long-eared myotis, long-legged myotis, small-footed (Yuma) myotis, and Townsend's big-eared bat.

According to Christophersen and Kuntz (2003), 12 species of bats are thought to inhabit North Cascades NPS Complex. Nine of the 12 species assumed to occur in the park appear on the Washington State Priority-Habitats and Species List, including eight species of the genus Myotis

Photo 20 – Western gray squirrel.

(*M. yumanensis*, *M. lucifugus*, *M. californicus*, *M. evotis*, *M. thysanodes*, *M. volans*, *M. ciliolabrum*, *M. keenii*) as well as the big brown bat (*Eptesicus fuscus*) (Washington Department of Fish and Wildlife 2002 in Christophersen and Kuntz 2003). In addition, both Keen's myotis (*M. keenii*) and Townsend's big-eared bat (*Corynorhinus townsendii*) are listed as Washington State candidate species (Washington Department of Fish and Wildlife 2002 in Christophersen and Kuntz 2003). Keen's myotis, however, is a coastal species expected to occur on the west side of the Cascade Crest and not expected from Lake Chelan NRA (Christophersen pers. comm. 2009). Currently, six forest bat species of the Pacific Northwest are listed as federal species of concern: *M. volans*, *M. thysanodes*, *M. evotis*, *M. yumanensis*, *M. ciliolabrum* and *Corynorhinus townsendii* (USFWS 2001a in Christophersen and Kuntz 2003).

**Range:** Each of these species is known to occur in coniferous forests, and the availability of roosting areas (for resting and for maternal sites) is an important habitat component for the bats. Roost sites range from cavities and loose bark in large trees and snags to abandoned buildings, caves, and crevices in rock cliffs (Nagorsen and Brigham 1993). Older forests generally provide higher-quality roost sites than younger forests (Christy and West 1993). Most roosting bats are extremely sensitive to human disturbance.

**Bat Habitat**

***Pacific Townsend's Big-eared Bat:*** Pacific Townsend's big-eared bats prefer coniferous forested habitat and hibernate in caves. They use loose bark in large trees, caves, crevices, and abandoned buildings for roosting. Nursery colonies are extremely sensitive to human activity, and sites are readily abandoned if disturbed. This species has not been detected in the Stehekin Valley.

***Western Long-eared Myotis:*** This species is found in a wide range of habitats, including arid grasslands and ponderosa pine forests to humid coastal and montane forests, and at high elevations. It has been documented from the Stehekin Valley. Buildings or tree bark serve as day roosts. Caves and mines are used as night roosts, while maternity colonies are usually found in buildings. They eat moths, beetles, flies, and spiders and catch insects on the wing as well as glean from vegetation or off the ground (Nagorsen and Brigham 1993).

***Long-legged Myotis:*** This bat occurs in arid range lands and interior and coastal montane forests. It uses buildings, crevices in rock cliffs, fissures in the ground, and tree bark for summer day roosts. It forages over ponds, streams, open meadows, and forest clearings and has been documented from the Stehekin Valley. Night roosts are usually in caves or mines. It eats mostly moths, but also termites, spiders, flies, beetles, leafhoppers, and lacewings (Nagorsen and Brigham 1993).

***Western Small-footed (Yuma) Myotis:*** This bat lives near cliffs and rock outcrops in arid valleys and badlands. In summer it roosts in cavities in cliffs, boulders, vertical banks, ground and talus slopes, and under rocks. Night roosts include small caves, abandoned mines, and buildings. It feeds primarily on caddis flies, but eats other flies, beetles, and moths. They usually hibernate alone in tight crevices (Nagorsen and Brigham 1993).

***Fringed Myotis:*** This bat ranges from Mexico to Canada, inhabiting desert, arid grasslands, and arid and/or coniferous forest habitat. It is associated with ponderosa pine-Douglas-fir forest in British Columbia. It roosts in tight clusters. It eats moths, flies, beetles, leafhoppers, lacewings, crickets, and harvestmen. Some prey is gleaned from foliage. Nursery colonies have been found in caves and buildings (Nagorsen and Brigham 1993).

### *Common Loon*

Common loons typically breed on forest lakes with deep inlets and bays (McIntyre and Barr 1997). Lakes often have small islands. During migration, they aggregate on rivers, reservoirs, and lakes. In winter, this species moves to shallow, sheltered marine waters. In all situations, loons require water bodies with ample prey populations (Richardson et al. 2000).

Between 1979 and 1999, a total of 20 confirmed and 12 unconfirmed nest sites were documented in Washington (Richardson et al. 2000). This includes one known site (Hozomeen Lake) in the Complex. Loons are uncommon on reservoirs throughout the park from April to October. McIntyre and Barr (1997) cite 20 ha as the minimum lake size needed for a pair of nesting loons. Most water bodies in Lake Chelan NRA are not suitable for nesting loons, because they are either smaller than the 20 ha minimum, fishless, or shoreline water fluctuations (reservoirs) would flood the nest or leave the nest site unprotected and/or too far from water.

### *Western Grebe*

This species is a locally common breeder on large freshwater ponds, lakes, and reservoirs in arid areas. In winter, it moves to coastal saltwater lagoons, or stays on large freshwater bodies that remain ice free. In the park, western grebes are rare spring and fall migrants to park reservoirs (R. Kuntz n.d. pers. field notes).

### *Bald Eagle*

**Habitat:** Bald eagles prefer riparian and open water habitats with tall trees and adequate fish and waterfowl prey species. Bald eagles have been observed occasionally perched in trees along the lower Stehekin River, where they occasionally forage for fish and roost in fall, winter, and spring. In the fall, eagles are likely using older trees in the valley for night roosting. There is an active bald eagle nest located at the mouth of the Stehekin River near the head of Lake Chelan. It has been active since it was identified in 2001. Bald eagles are also seen in the fall and winter in this area. In 1995, the USFWS estimate of the lake's wintering population was five birds (NPS LACH 1995a:193). Bald eagles also use portions of the river adjacent to the Stehekin Valley Road. The nearby Skagit River watershed supports one of the largest wintering populations of bald eagles within the contiguous United States (NPS LACH 2007).

### *Peregrine Falcon*

Peregrine falcons usually nest on high cliffs and buttes, near water where avian prey species are most common (Johnsgard 1990). The species forages on a large variety of birds, and birds that regularly fly high in a way that exposes them to the peregrine's typical diving attack; namely, highly mobile, flocking, and colonially nesting species such as waterfowl and shorebirds. These species are particularly valuable prey (Johnsgard 1990).

Peregrine falcons have been sighted in the valley, but there are no records of nests. The steep, rocky cliffs along the Stehekin River provide suitable nesting and foraging habitat, particularly on the northeast side of the valley on the southwest-facing slopes of Rainbow Mountain between 2,800 and 5,600 feet in elevation, however, this habitat is not within the proposed project area.

### *Northern Spotted Owl*

**Range:** Northern spotted owls occupy structurally complex forested habitat in mature or old growth forests, where trees are of variable species, sizes, and ages, and snags and multi-storied canopies are present. They are found from British Columbia throughout the Pacific Northwest and into California.

**Habitat:** In 1993, park surveys located three nesting pairs and two additional single owls, all between the mouth of Bridge Creek and the southern boundary of Lake Chelan NRA. Since 1993, known pair sites in the Stehekin Valley and its tributaries up to the mouth of Bridge Creek have been surveyed three times each year. Sites where single owls have been observed have been surveyed most years at least once. Most of the pair sites are outside the proposed project area vicinity.

One pair, however, has been active within the project area for many years. Located approximately 500 feet from the Stehekin Valley Road on the south side of the Stehekin Valley, the pair was discovered in July 1998 during a cavity-nesting bird survey. Later, this discovery was confirmed when an adult pair and three juveniles were observed. Three birds were banded in August 1998 (Table III-11: *Summary Status for the McGregor Meadows Northern Spotted Owl Activity Site*).

Photo 21 – Northern spotted owl.

**Table III-11: Summary Status for the McGregor Meadows Northern Spotted Owl Activity Site**

| Year | Occupancy (Presence of Northern Spotted Owls) | Reproduction? | Notes |
|---|---|---|---|
| 1998 | Pair occupancy confirmed. | Reproduction confirmed. | 2 young banded. |
| 1999 | Pair occupancy confirmed. | Reproduction unknown. | |
| 2000 | Single occupancy confirmed (male). Pair occupancy unknown. | Reproduction unknown. | |
| 2001 | Occupancy unknown. | Reproduction unknown. | |
| 2002 | Occupancy unknown. | Reproduction unknown. | |
| 2003 | No surveys. | | |
| 2004 | Single occupancy confirmed (male). Pair occupancy unknown. | Reproduction unknown. | |
| 2005 | Pair occupancy confirmed. | Reproduction confirmed. | 2 juveniles fledged. |
| 2006 | Pair occupancy confirmed. | Reproduction confirmed. | 1 juvenile observed. |
| 2007 | Pair occupancy confirmed. | Productivity failed or nonnesting. | |
| 2008 | Site unoccupied. No northern spotted owls detected. | Reproduction unknown. | Pair of barred owls found. |
| 2009 | Site Unoccupied. No spotted owls detected. | Reproduction unknown. | Pair of barred owls found. |
| 2010 | Site occupancy confirmed (male). Pair occupancy unknown. | Reproduction unknown. | |
| 2011 | Site occupancy confirmed | Reproduction unknown. | Pair occupancy unknown |

*Note: Several owls have been identified in the Stehekin Valley since 1993. Of those, a number of pairs have produced young.*

The USFWS Action Area for this former northern spotted owl nest site in the Stehekin Valley (USFWS 2005) has a radius of 0.7 miles, which extends out from the nest tree in all directions. No construction work can occur within this area during the nesting season (March 1 to September 6, depending on fledging of young).

**Recovery:** The Stehekin River watershed is a Designated Conservation Area (DCA) for the northern spotted owl. The Recovery Plan for the species identifies most of the Stehekin Valley as a DCA. Based on the USFWS 1992 Draft Recovery Plan, there are four DCAs (WD-31, WD-33, WD-34, and WD-35) partially or wholly within lands managed by North Cascades NPS Complex. Within the four DCAs there are 35,730 acres of suitable habitat for northern spotted owls. There are 21 DCAs in the eastern Washington Cascades province. DCA WD-33 is within the proposed project vicinity.

In 1995 it was estimated that 2,500 acres of suitable habitat were available for owls from the Lower Field downvalley to Lake Chelan (see USFWS 1995). NPS fuel management actions in the lower valley, as defined in the *Forest Fuel Reduction/Firewood Management Plan* (NPS LACH 1995g), will reduce suitable habitat by 299 acres. For this reason, implementation of the NPS *Forest Fuel Reduction/Firewood Management Plan* required issuance of an "incidental take" permit from the USFWS for the fuel reduction actions in the valley below the Lower Field.

### *Golden Eagle*

The 1995 GMP reports only 80 breeding pairs of golden eagles in Washington State (NPS LACH 1995a:194). Golden eagles are associated with open areas containing low-lying shrubs, grasslands, open areas, or open ponderosa pine forests (Watson and Whalen 2003 in NPS 2006a). Golden eagles nest on cliffs or in large trees and prey on mid-sized mammals, including rabbits, ground squirrels, and marmots. Golden eagles have been observed foraging along the lower Stehekin River near the head of Lake Chelan in winter (NPS NOCA 2006c).

### *Merlin*

Merlins are associated with habitats similar to the golden eagle, and are generally not found in the Stehekin Valley. Merlins eat small, open-country birds such as larks, swallows, and finches as well as small mammals and insects. Three wildlife observation database records for merlins have been identified from the Stehekin Valley (in June 1986, May 1993, and September 1995) (NPS NOCA 2006c). These records probably represent birds migrating through the valley, since the dense forests characteristic of the valley do not provide suitable nesting habitat for this species.

### *Northern Goshawk*

Northern goshawks are present in upland mesic coniferous forests and deciduous riparian forests in the Stehekin Valley. Northern goshawks fly below the canopy in mature or old-growth forests to forage for ground-dwelling birds, ducks and mammals and nest in large trees. Goshawk nests have been documented on the shore of Lake Chelan south of the Landing and above High Bridge.

### *Harlequin Duck*

Harlequin ducks occur in mountain stream environments during the breeding season. Their breeding habitat consists of clear, clean, fast-flowing, low-gradient (less than three percent) mountain streams (second order or larger) with rocky substrates and riparian bank vegetation (USFS 1992). Nests may be located on top of stable cut banks, on side slopes of streams, on steep slopes, in undercut stream banks, in cliff cavities above the stream, and in piles of woody debris (MacCallum 2001), as well as in hollow trees and snags (Cassirer et al. 1993).

Surveys completed in the early 1990s concluded that seven to 11 pairs nest along the Stehekin River between High Bridge and the head of Lake Chelan, among the highest nesting density recorded on any North American river. Most were found between Rainbow Creek and Harlequin Bridge, with the greatest concentration near the Buckner Homestead hayfield and pasture. Harlequins arrive in April and start nesting by the beginning of May. Young are usually first seen on the Stehekin River and its tributaries by late June - early July. Males leave the river by early July, migrating back to the Pacific Coast. Females and juveniles return to the coast in August to early September.

### *Lewis's Woodpecker*

Lewis's woodpeckers inhabit recently burned areas in open woodlands and forests. There is one 1971 record of this species at the head of Lake Chelan from the wildlife observation database (NPS NOCA 2006c).

### *Black-backed Woodpecker*

The black-backed woodpecker occurs in montane and pine forests, where it is confined mostly to burned areas with abundant snags (USFS 1992; Dixon and Saab 2000). Recent burns provide outbreaks of bark beetles, which are the main prey for this woodpecker (Dixon and Saab 2000). In the absence of burns, this woodpecker will forage in areas with diseased trees. Most studies indicate that the species prefers to forage on dead trees rather than live trees (Dixon and Saab 2000).

There are three records of these birds observed in the lower Stehekin Valley from the Wildlife Observation Database (1984 - 2001) (NPS NOCA 2006c). All three records occurred between July 25 and August 13. According to staff biologists, they probably represent post-breeding movement. In the project area, black-backed woodpeckers would be uncommon, due to the lack of high-intensity burned areas and/or diseased areas with abundant snags.

### *Pileated Woodpecker*

Pileated woodpeckers are known to be present and nest in lowland forests in the Stehekin Valley. They are found within Douglas-fir and ponderosa pine forests as well as in mature riparian forests. They excavate large rectangular holes in search of carpenter ants. These cavities are later used by saw-whet and screech owls, Vaux's swifts, flickers, chickadees, bluebirds, flying and tree squirrels, woodrats, and bats.

### *Black Swift*

According to the Seattle Audubon Society's Bird Web (www.birdweb.org), the Black Swift is an uncommon breeder in forested habitats at moderate elevations in the northern Cascades (both east and west sides north of Snoqualmie Pass). Black Swifts require a specialized habitat for nesting, in forested areas near rivers, where their nests are often located behind waterfalls or on damp cliffs where the environment is dark, wet, steep, and inaccessible to predators. This provides the birds with an unobstructed way to approach the nest. Black Swifts may nest singly or in small colonies. Nests may be reused from year to year, with more material added each year. Black Swifts are patchily distributed, with apparently stable numbers. Because of the difficulty in locating and observing nests, however, this species' ecology is not well known.

### *Vaux's Swift*

Vaux's swifts are common in April or May through September in the Stehekin Valley. They require large, hollow snags or cavities in the broken tops of live trees for nesting and roosting. Nesting occurs from June through August. Based on studies in Oregon, Vaux's swifts prefer grand firs for nesting and roosting (NPS NOCA 2006c). Swifts forage over open water. At least two pairs have been identified in the valley (NPS LACH 1995a:196).

### *Olive-sided Flycatcher*

The olive-sided flycatcher is a common species associated with edges and forest openings where tall trees are present. It prefers sites with large forest patches adjacent to cleared areas, burns, or water bodies. Olive-sided flycatchers feed almost exclusively by catching insects on the wing. They perch in tall trees adjacent to openings between feeding flights. Long and short-term declining trends are occurring in the lowlands and valleys, Cascade Mountains, and in Washington. Within the Stehekin Valley, Kuntz and Glesne (1993) documented these flycatchers using deciduous riparian forests along the Stehekin River.

### *Bull Trout*

**Range:** The Stehekin River is within the range of Columbia River bull trout. Historically, bull trout inhabited the Stehekin River and Lake Chelan; however, the last confirmed report of bull trout in Lake Chelan was in 1957 (Brown 1984 in NPS LACH 1995a:189) and they are now considered to be extirpated from the lower Stehekin River (NPS LACH 2007). A large number of sick and dying bull trout had been observed in the fall of 1951 and there were few reports of the fish after that. In 1993, there were several unconfirmed reports of bull trout being captured in the Stehekin River (FERC 2002 in NPS 2006a; NOAA Fisheries 2004). Little is known about the historical status of bull trout in Lake Chelan. Some remnant bull trout may reside in tributaries to Lake Chelan, however verified captures from the lake have not occurred in two decades (FERC 2002 in NPS 2006a).

Although their fall spawning run in the Stehekin River was once a major angler and tourist attraction, based on the results from numerous creel and habitat surveys, bull trout are presumed to be extirpated from the Stehekin River. The project area does not contain designated or proposed bull trout critical habitat. Nonetheless, in the recreation area, bull trout habitat is managed to (1) avoid further degradation, (2) protect any potential remaining individuals or populations, and (3) preserve the option of species restoration.

**Life History:** Like rainbow trout/steelhead, bull trout exhibit two distinct life history strategies: resident and migratory. Resident bull trout spend their entire lives in headwater streams. Migratory populations spawn in headwaters, where rearing takes place. Juveniles then migrate downstream to larger rivers, lakes, or the ocean, where they mature before returning to the headwaters to spawn. Spawning occurs in the fall, with emergence in spring. Bull trout primarily feed on bottom-dwelling and drifting aquatic insects; however, larger fish mostly eat smaller fish.

**Habitat:** Bull trout juveniles feed on invertebrates and other fish, but primarily eat fish as adults. Optimal habitat is characterized by clear, cold water and gravel-cobble substrates free of fine sediments, abundant instream cover, and deep pools (Rieman and McIntyre 1993 in NPS 2006a). Bull trout populations are associated with high channel complexity and cold stream reaches within a basin (Rieman and McIntyre 1993 in NPS 2006a).

**Threats:** Bull trout are rapidly declining throughout their range. Identified risks to bull trout include dams and diversions, overharvest, habitat degradation, competition from and hybridization with competing species such as brook trout, and population fragmentation (Bader et al. 1993 in NPS LACH 1995a:190; Lee et al. 1997 in NPS 2006a).

### *Dolly Varden*

Dolly Varden were formerly proposed as threatened under the similarity of appearance provision of the Endangered Species Act. They occupy the same habitats and have nearly indistinguishable characteristics from bull trout. Dolly Varden do not occur in the Stehekin River.

### *Westslope Cutthroat Trout*

Westslope cutthroat trout were once the dominant sport fish in Lake Chelan. A combination of factors, including hatchery egg harvesting, introduction of competitive sport fish such as rainbow and brook trout and kokanee salmon, hybridization with rainbow trout, construction of the Chelan dam, and overfishing, led to a much-reduced population after 1910. Hatchery-reared fish began to be planted in Lake Chelan, its tributaries, and high mountain lakes in the mid-1920s.

**Range:** Native westslope cutthroat trout occur in the Stehekin River and its tributaries, including Bridge, Park, Canim, Buzzard, and McGregor creeks. Population densities in the upper Stehekin River and in Bridge and Park creeks are some of the highest recorded in the continental United States (FERC 2002 in NPS 2006a). Below Bridge Creek, the cutthroats hybridize with rainbow trout.

**Life History:** Similar to bull and rainbow trout, westslope cutthroat trout also exhibit both resident and migratory life history strategies. Cutthroat trout spawn in the spring to mid-summer (between March and July) in low-gradient stream reaches that have clean gravel substrate in close proximity to cover (overhanging rocks, stream banks, or vegetation) (Behnke 1992; McIntyre and Rieman 1995 in NPS 2006a).

**Habitat:** Westslope cutthroat trout fry generally occupy shallow waters near stream banks and other low-velocity stream areas (backwaters or side channels); juveniles are most often found in pools and riffles (McIntyre and Rieman 1995 in NPS 2006a). Adult westslope cutthroat are associated with cold, high-gradient reaches that have pools and cover (Shepard et al. 1984; McIntyre and Rieman 1995 in NPS 2006a). Among the characteristics that identify westslope cutthroat trout habitat are clear, cold water; silt-free substrate in riffles; equal areas of pools and riffles; areas of slow, deep water; well-vegetated stream banks; abundant instream cover; relatively stable flow regimes and stream banks; and productive insect populations (Hickman and Raleigh 1982; Fraley and Shepard 1989 in NPS LACH 1995a:189).

**Threats:** Risks to westslope cutthroat trout are the same as those affecting bull trout (Lee et al. 1997 in NPS 2006a).

### *Chinook Salmon*

The largest of the Pacific salmon, Chinook salmon (king salmon) weigh between 12 and 40 pounds and have a silvery olive-brown and purple coloring. They prefer freshwater streams and deep pools, though they eventually migrate to the ocean. Wild Chinook persist in the Skagit River watershed, along with all five Pacific salmon species (NPS LACH 2007). Chinook salmon were stocked in the Chelan Subbasin. Landlocked Chinook have established resident lake populations and currently spawn in the Stehekin River, Company Creek, and Blackberry Creek (FERC 2002 in NPS 2006a). Although Chinook have been stocked, they were not native to the watershed prior to stocking. They are a stocked, reproducing population of non-native fish.

### *Western Toad*

Western Toads range in elevation from sea level to 2,250 meters amsl. Oviposit sites and aquatic habitats include lakes, springs, ponds, wetlands, stock ponds, and slow-moving parts of streams. Terrestrial habitats are forests, grasslands, and along streams. Western toads are most common near marshes and small lakes, but they may wander great distances through dry forests or shrubby thickets. Outside of the breeding season, western toads are nocturnal, spending the day buried in the soil, concealed under woody debris, or in the burrows of other animals. The western toad has been documented in the Stehekin Valley as the most frequently encountered amphibian in the Stehekin Valley (Kuntz and Glesne 1993). Adults live underground and can be found near breeding habitats in upland areas, particularly near seeps.

### *Columbia Spotted Frog*

The Columbia spotted frog is nearly always found in or near a perennial water body (required for breeding) such as a spring, pond, lake, or stream backwater. It is most often associated with non-woody wetland plant communities (sedges, rushes, and grasses). Breeding occurs in February or March at lower elevations of eastern and western Washington but does not occur until late May or early June at higher elevations. Kuntz and Glesne (1993) and others (e.g., Nussbaum et al. 1983 in NPS LACH 1995a:195) have documented this species in the Stehekin Valley.

### *Cascades Frog*

The Cascades frog is found in quiet, sometimes ephemeral, ponds for breeding. Eggs are deposited in shallow water near the shoreline. Egg development through metamorphosis requires between 40 and 60 days, depending on water temperature. Aquatic and terrestrial insects comprise their diet. Cascades frogs are active from early spring through late fall. They estivate in mud over the winter. A 1991 survey found Cascades frogs in a variety of habitats in the Stehekin Valley (Kuntz and Glesne 1993), including on the south side of the Stehekin River, on Battalion Creek, in riparian areas south of the airstrip, and in overflow channels along the river.

### *Tailed Frog*

Tailed frogs are stream-breeding amphibians that occupy cold, rocky, mountain streams (Leonard et al. 1993). Adult tailed frogs occupy streamside and forest habitats adjacent to streams. Tailed frogs are not expected to occur in the Stehekin River adjacent to the project road alignment, due to the relatively large size and low gradient of the river in this area. The frogs may occur in higher-gradient streams above the Stehekin River and road alignment.

## 10. Cultural Resources

Most of the proposed project area has been surveyed for the presence of cultural resources, including archeological and ethnographic resources and historic buildings and structures. Accordingly, a review has been conducted of relevant literature and cultural resources inventory lists.

**Stehekin River Corridor Implementation Plan Project Area Summary:** The project area includes the lower Stehekin Valley, from High Bridge to the head of Lake Chelan, including Weaver Point.

**Area of Potential Effects:** As defined under Section 106 of the National Historic Preservation Act (NHPA), the area of potential effects (APE) of each undertaking would be specified following a concise description of the project's associated NHPA undertakings.

The following cultural resources are within or adjacent to the project area:

- Historic Archeological Resources:
    - Stehekin Wagon Road (45CH429), a discontinuous linear historic archeological feature.
- Cultural Landscapes:
    - Buckner Homestead Historic District (National Register Number [NR] 88003445).

These resources are currently listed on or have been formally determined eligible for the National Register of Historic Places. A number of other cultural resources are near the project area and would not be directly affected by the proposed actions contained within the alternatives described herein.

The following cultural resources are within or near the project area but would not be affected by proposed actions:

- Archeological Resources
    - 55 total archeological sites in the Stehekin Watershed (historic and pre-contact periods);
    - 12 pre-contact period archeological sites in the project area; and
    - 7 historic-period archeological sites in the project area.
- Historic Buildings and Structures
    - Stehekin School (NR 74000913);
    - George Miller House (NR 88003464);
    - Purple Point—Stehekin Ranger Station House (NR 88003460);
    - Harlequin Bridge; and
    - Buckner Cabin (NR 74000912).
- Cultural Landscapes
    - Golden West Lodge Historic District (NR 88003442); and
    - High Bridge Ranger Station Historic District (NR 88003443).

## Archeological Resources

The following studies document lower Stehekin Valley and Lake Chelan archeological resources:

- Archeological Overview (Mierendorf 1986);
- National Register Nomination (1989);

- Archeological Basemap (1990); and
- Archeological Site Assessments (Mierendorf and Harry 1992, Ozbun et al. 2005).

Prior to 1986, archeological surveys in the lower Stehekin Valley and head of Lake Chelan area were conducted sporadically by university-based consulting archeologists. In the early 1970s, using information provided by local residents, Rice conducted a survey of the Stehekin Valley Road prior to proposed road improvements and collected information on five pre-contact-age sites and other information linked to indigenous uses of the Stehekin area (Rice n.d.). In the summer of 1977 a team of graduate students from Western Washington University surveyed in the upper and lower valley, where they recorded three sites and conducted test excavations at High Bridge (45CH69) (Grabert and Pint 1978). From 1984 to 1986 Bob Mierendorf, employee of Washington State University and contracted by NPS, performed reconnaissance-level cultural resource surveys and visited and documented previously recorded archeological sites to gather background data for the preparation of the park's archeological overview and research design (Mierendorf 1986). Nine previously unrecorded pre-contact-age sites were documented in the Stehekin-Chelan watershed, thus increasing the total site inventory in the Stehekin watershed to 17 sites and to 28 sites in North Cascades NPS Complex. Today, the North Cascades NPS Complex-wide inventory of all archeological sites is 310.

Beginning in the summer of 1986, cultural resources surveys in the Stehekin watershed (as elsewhere in North Cascades NPS Complex) were conducted by NPS archeologist Bob Mierendorf or by survey teams under his direction. The survey strategies consisted of two types: non-intensive reconnaissance-level surveys and intensive inventory-level surveys. The reconnaissance-level surveys provide an overview of the watershed's pre-contact- and historic-period archeological resources, while the compliance surveys cover smaller areas in great detail. Results from both survey strategies have revealed the widespread presence of a variety of site types in all elevation zones of the Stehekin watershed.

Although archeological surveys provide useful data regarding the types and geographic distribution of pre-contact sites, only controlled excavations of site deposits and analysis of the resulting collections yield information sufficient for assessment of National Register eligibility. To date in the Stehekin watershed, four pre-contact period archeological sites (45CH411, -412, -69, and -221) have been assessed for eligibility through limited test excavations. Two of these sites are within the vicinity of the project area (45CH412 and -69): one at Buckner Homestead hayfield and pasture and one at the High Bridge Guard Station. Neither of these sites is within the project action area.

The first, the Buckner Orchard Site (45CH412), was found to contain intact deposits nearly one meter in depth with artifacts and prepared cooking features radiocarbon-dated at between 500 and 3,000 years old (unpublished site excavation records); this site has been informally assessed as eligible for the National Register of Historic Places and is protected within the boundary of the Buckner Homestead Historic District.

The second, 45CH69, is located at the High Bridge Guard Station and was first test-excavated in 1977, but with poor results (Grabert and Pint 1978). In 2000 an intact pit feature was found buried under the floor of the historic garage; a large chipped stone tool assemblage excavated from inside and around the edges of the feature dated from several hundred years old at the top to 6,500 years old at the bottom, nearly one meter below the garage floor (unpublished site excavation records). This site has been informally assessed as eligible for the National Register of Historic Places and it is protected within the boundary of the High Bridge Ranger Station Historic District.

The overall results of these investigations reveal a long and complex history of indigenous involvement with the Stehekin watershed. For at least 9,500 years, indigenous groups have been crossing the northern Cascade Range at Cascade Pass, located at the head of the Stehekin watershed, and using it as a temporary camp for hunting and gathering forays in the surrounding mountains. Presently, Cascade Pass is the oldest radiocarbon-dated site in the Stehekin watershed, in North Cascades NPS Complex, and in the Cascade Range of Washington and British Columbia. At the time of European contact, about A.D. 1800, Lake Chelan and the Stehekin River valley were the traditional homeland of the Chelan Indians, who used the valley for hunting and gathering and as one of several travel corridors across the rugged northern Cascade Range. Today, descendants of these original inhabitants are associated with two eastern Washington federally recognized tribal governments, the Colville Confederated Tribes and the Yakama Nation.

Numerous cultural resources surveys have been conducted within the proposed project action area over nearly two decades. The surveys were conducted pursuant to several types of proposed NPS undertakings, including road storm damage repair, road realignment, road resurfacing, trail construction, and fire management activities. The most recent survey for the proposed road modifications was conducted in July 2008 by Bob Mierendorf, North Cascades NPS Complex archeologist, and Ray DePuydt, Lake Roosevelt National Recreation Area archeologist.

Archeological surveys have been conducted in areas associated with proposed actions in all alternatives and/or would be conducted and/or monitored during soil-disturbance activities. These areas include the existing roadway; proposed relocated maintenance facility and housing near the airstrip; turnout locations along the existing Stehekin Valley Road (including areas of paving, culvert installation and replacement, and side ditch construction / reconstruction); the proposed winter turnaround / parking area; and areas along the Stehekin River previously disturbed by road improvements (including near Milepost 5.3 [Wilson Creek], Milepost 8.5, and the McGregor Meadows area); areas needed to construct the proposed Lower Valley Trail); the proposed reroute area; and areas that could be affected by ongoing implementation of land acquisition and exchange priorities from the 1995 LPP (NPS LACH 1995b).

### *Pre-contact Period Archeological Resources*

None of the 12 pre-contact period sites within the project area are located in areas that are proposed for undertakings (APE). As additional detailed plans are completed and APEs for each undertaking are detailed, however, the park will comply with Section 106 of the NHPA to determine effects to cultural resources. Pre-contact archeological site types represented in the project area include lithic scatters (concentrations of chipped stone tools and fire-modified rocks, sometime buried up to one meter deep), rockshelters, pits in the ground, rock walls and cairns, and pictograph sites. Any of these site categories are potentially eligible for the National Register of Historic Places.

Two sites in the project area have been informally recommended for National Register eligibility, the Buckner Orchard Site (45CH412) and the High Bridge Guard Station Site (45CH69), and each is inside the boundaries of a listed National Register historic district. Neither of these sites is within the project action area.

Three other sites appear to be eligible for inclusion in the National Register and are managed as significant. All of these are rockshelters with associated pictographs (45CH427, 45CH450, and 45CH455) and are considered to have traditional cultural significance. Although within the project area, they are outside of the project action area of any of the potential undertakings.

**Table III-12: Overview of Pre-contact and Historic Period Archeological Sites in the Lower Stehekin Valley**

| Pre-contact Period Archeological Sites | |
|---|---|
| Courtney Ranch (45CH68) | Bullion Boulder (45CH427) |
| High Bridge Guard Station (45CH69) | Bullion Fan (45CH428) |
| Buckner Homestead hayfield and pasture (45CH412) | Rainbow Creek 1 (45CH431) |
| Bullion Bar (45 CH416) | Little Boulder Creek 1 (45CH432) |
| Boulder Creek 1 (45CH407) | McGregor Rockshelter (45CH450) |
| Boulder Creek 2 (45CH408) | Harlequin Rockshelter (45CH454) |
| Historic Period Archeological Sites | |
| Stehekin Wagon Road (45CH429) | Harlequin Bridge Abutment (45CH459) |
| Weaver Point Historic Site (45CH452) | Lower Buckner Field Can Dump (45CH455) |
| Buckner Lane Historic Site (45CH451) | Lower Field Irrigation Ditch (45CH468) |
| Stehekin Community Can Dump (45CH499) | |

### *Historic Archeological Resources*

Historic archeological sites in the project area include a bridge abutment (45CH459), irrigation ditch (45CH468), historic artifact debris scatters (45CH455 and 45CH499), historic debris and structure depressions (45CH452), and road and trail segments (45CH429 and 45CH451). Two of these sites have the potential to be affected by project implementation, the Weaver Point Historic Site (45CH452) and the Stehekin Wagon Road (45CH429).

The first, the Weaver Point Historic Site, was test-excavated and assessed as eligible for inclusion in the National Register of Historic Places. The assessment was performed by a consulting firm under contract to Chelan PUD and working on NPS lands under authority of an ARPA permit issued by NPS to perform archeological studies in advance of the Chelan PUD's application for a license to continue operation of the Lake Chelan reservoir. It is likely that at least one of the two building remains, a dugout cabin foundation, is the Devore/Pershall cabin; historic artifacts recovered in the assessment point to an early historic-period residential occupation dating between 1886 and 1900 (Ozbun et al. 2005:51 - 59).

The second site, the Stehekin Wagon Road (45CH429), is a linear feature consisting of many discontinuous segments of now-abandoned roadbeds. Some of these segments may be the remains of the first Stehekin Wagon Road. Beginning in the early 1890s, plans were made for construction of roads linking mines in the upper valley with the head of Lake Chelan. The Stehekin Wagon Road was built between 1894 and the early 1900s to transport people and supplies to the mining communities at Bridge Creek and Horseshoe Basin. The original wagon road was constructed from the head of the lake along the south side of the valley up to the end of present day Company Creek Road. At that point, it crossed the river to the north side of the valley and then continued upvalley.

The wagon road on the south side of the Stehekin River was declared a public highway in 1892 and designated the Stehekin River County Road. After this initial road was roughed out it was used for a few years, but fell into disuse following the building of a new dock on the north side of the Stehekin River (Mierendorf 2009). At that point, most travel up the valley was, as it is today, on the current Stehekin Valley Road side as far as Bullion. Here the old road left the current road and began the approximately 400-foot ascent that brought the road almost to the elevation of Coon Lake. An unknown time later, a bridge was built over the Stehekin River at High Bridge in order to avoid the climb to Coon Lake. At today's High Bridge one can see an earlier roadbed immediately west of and below the current bridge.

Early historic-period roads in the lower Stehekin River Valley are potentially of local historic significance because they represent a critical aspect of late-19th-century mining development and settlement and recreational activities in the valley. Although the important roles that roads served in the Stehekin Valley's economic and settlement history is generally acknowledged, historic records documenting details of road histories and uses are rare (Mierendorf 2009).

Site 45CH429 is a linear historic archeological feature. Abandoned road segments within the project action area are common and can be recognized by one or a combination of several constructed road features. These extant road features consist of:

- Scraped or leveled road sections (10 - 13 feet or three to four meters wide) marked by a line or low mound of rocks and boulders that were moved to one or both sides of the roadbed;
- Traces of roadbed visible as unforested corridors through the otherwise closed-canopy forest;
- Retaining walls built of subangular rocks and boulders (of immediately local origin) to create or maintain a level roadbed across slopes or other natural terrain features; and
- Roadbed cuts into existing terrain that created or maintained a low-gradient road alignment profile through high ground.

Road segments are discontinuous and cannot clearly be linked to each other due to erosion and/or burial by hillslope runoff, snow and rock avalanches, deposition of debris cones and alluvial fans, overgrowth of native shrubs and trees, multiple episodes of road rebuilding and repair, and development associated with adjacent private residences. Most disturbance to the physical integrity of these road segments occurs in the lower Stehekin Valley, where most people live and where development is the greatest; above approximately Milepost 8.0, these road segments appear to retain more historic integrity.

Within the proposed reroute project action area between the head of Lake Chelan and Milepost 9.2, two sets of built rock features clearly define abandoned road segments. These discontinuous segments of Site 45CH429 parallel the existing Stehekin Valley Road near Mileposts 6.3 and 8.2. In addition, outside the project action area, there is an additional segment of the road.

### Milepost 6.3

The first set of features believed to represent a segment of the Old Wagon Road is located within the project action area above the existing Stehekin Valley Road at approximately Milepost 6.3. This feature was observed and recorded in May 1996 and revisited in July 2008, and consists of three closely spaced rock wall segments built on the downhill side of an abandoned roadbed where it traverses the sloping toe of a large, boulder-strewn debris cone. The three segments are 22, 34, and 46 feet (7, 10.4, and 14 meters) in length and together they span a distance of 360 feet (109.8 meters). The highest measured wall is 4.5 feet (1.4 meters) (six to seven courses of rock) and the lowest is 1.6 feet (0.5 meter) high (one to two courses of stone) (Mierendorf 2009).

Walls were built of locally derived, subangular cobbles and boulders that were stacked and fitted— sometimes tightly, but in most cases they appear to have been loosely piled. The rock walls served to hold and stabilize the downhill side of the constructed roadbed. They also retain an even bed of rocks and earth, where the road crosses shallow gullies and dips eroded into the toe of the debris cone. Portions of the rock walls are overgrown by lichens and native shrubs and have begun to dismantle through the processes of natural weathering and disturbance. As inferred from the wall design and construction techniques, the builders favored opportunistic and energy-minimizing techniques—in particular, moving aside or repositioning boulders and piling smaller rocks against and around larger boulders that served to anchor the wall segments. The age of the rock walls, their builders, and the history of maintenance or rebuilding are currently unknown. Because the "original" Stehekin Valley wagon road is reported to have been on the other side of the valley at this mile point, this road segment may be associated with the road that subsequently replaced the earlier road following the building of a new dock on the north side of the Stehekin River at the head of the lake (Mierendorf 2009).

Based on archeological analysis, the features appear to lack integrity of association and workmanship; their age and affiliation with an original or early Stehekin Valley Road cannot be demonstrated; and they do not represent the best example of early road design and construction techniques. These features therefore do not appear to meet National Register eligibility criteria (Mierendorf 2009).

### Milepost 8.2

The second road segment, near the present Stehekin Valley Road, covers an area of about 3,937 feet by 33 feet and also includes a rock retaining wall about seven feet high where the road was built around a rock outcrop (NPS LACH 1995a:202). It has been determined to be potentially eligible for inclusion on the National Register (see below).

This set of rock features is located at approximately Milepost 8.2, on the north side of the river, and was recorded in 1992 as the "Stehekin Wagon Road" (FS #212; 45CH429). This road segment is approximately 197 feet (60 meters) long and most of it is cut shallowly into the top of an alluvial fan. A much shorter dry-stacked rock wall segment consists of a lower foundation (or footing course of rocks) with a dry masonry rock wall built on top of this from several courses of locally derived subangular cobbles and boulders to a maximum height of 4.9 feet (1.5 meters); the roadbed is ten feet (three meters) wide (Mierendorf 2009).

The wall segments here vary from intact to disturbed (disturbance caused by stream erosion and natural deterioration). The wall is located above a steep slope where the road was constructed around a bedrock outcrop. It appears that rather than blasting out the bedrock, the road was built to go around it. The footing and retaining walls were built on the downslope side of the rock outcrop and the space between the wall and the outcrop was filled with small subangular rocks to create a fairly level roadbed. Compared to the rock walls at Milepost 6.3, the rock walls at Milepost 8.0 were built with more care and represent a much greater investment in time and energy, and because of their location were part of the road from its initial construction. A Ponderosa pine growing on the roadbed fill at this site was cored with an increment borer and found to be 78 years old, indicating that this part of the roadbed was built prior to 1914 (Mierendorf 2009).

Unlike the features at Milepost 6.3, based on analysis, the features associated with Milepost 8.0 do appear to retain integrity of association, workmanship, location, and setting. In addition, tree core data indicate that this road segment was built prior to 1914, consistent with the early mining period in the Stehekin Valley. Integrity of location, design, materials, and workmanship at this site therefore appear to preserve significant historic features directly associated with early transportation and the development of the mining industry in the Stehekin watershed and the northern Cascade Range. This cultural resource appears to meet National Register eligibility criteria at local and statewide levels of significance (Mierendorf 2009).

#### Coon Run Vicinity (approximately 20 feet to the east of the existing roadbed)

Above Milepost 8.2, outside the project action area, is another segment, potentially part of the Old Wagon Road described in the Coon Run EA associated with flood damage improvements to the Stehekin Valley Road in that area (NPS LACH 2005b).

This roadbed extends for approximately 300 feet. The wagon road remains are 15 feet wide. Rocks and soil scraped from the bed form a rock berm, or boulder line, on either side of the road. This road segment is devoid of artifacts or built road features such as retaining walls, foundation rocks, or drainage features. The existing road segment disappears abruptly at either end, where it has been truncated by road cuts created during construction of the present Stehekin Valley Road. Although the age of this road segment is unknown, it does not appear to be part of the original Stehekin Wagon Road because this segment is west of Bullion, and therefore cannot be the same road that climbed to the Coon Lake elevation. The Coon Run EA stated that the wagon road segment (considered part of 45CH429) near Coon Run does not appear to be eligible for inclusion in the National Register of Historic Places (NPS LACH 2005b).

### Historic Buildings and Structures

The following studies document Lake Chelan historic resources:

- Historic Structure Inventory (1984);
- Historic Resource Study (1970/1986);
- Historic Structures Preservation Guide (1987); and
- Resource Management Plan (1993).

Historic contexts identified in the *North Cascades National Park Service Complex Historic Resource Study* (NPS 1986) included exploration, settlement, commercial development, recreation, and administration of the area by the USFS. These contexts, and the inventory data provided by these studies, were summarized in the multiple-property resource nomination prepared for the National Register, “Historic Resources of North Cascades National Park Service Complex.” As a result of this nomination, 28 buildings and three Historic Districts were listed on the National Register in the project area.

The following buildings, structures, historic districts, and cultural landscapes within the project area are listed or are eligible for listing in the National Register of Historic Places: Buckner Homestead Historic District, Courtney / McComb Cabin, George Miller House, Golden West Lodge Historic District, Harlequin Bridge, High Bridge Ranger Station Historic District, Stehekin Ranger Station Residence, and the Stehekin School.

- **Buckner Homestead Historic District:** See “Cultural Landscapes.”
- **Courtney / McComb Cabin:** The Courtney Cabin, listed on the National Register of Historic Places, is located on the north side of Company Creek Road, near the south shore of the Stehekin River about five miles from the Landing. It is a log and wood-frame structure significant for its association with early homesteading in the valley. Hugh Courtney moved uplake with his family in the 1910s to work at the Stehekin sawmill. In 1918, he filed a claim for 53 acres and moved into a log cabin built by a previous squatter in about 1889. By the 1920s, he had built the wood-frame portion, doubling the size of the home; cleared and plowed land for a garden; and built a cellar, barn, and hayshed. He lived in it with his wife until the 1950s. Afterward it began to deteriorate as a rental unit until acquired by the NPS in 1971 (NPS LACH 1995a:205).

  The historic cabin is experiencing increased flood damage (e.g., water flowing through structure when road floods). It was moved once, but likely needs to be moved again due to changing conditions. The cabin is outside the project action area. (Addressing the damage is beyond the scope of this DEIS.)
- **George Miller House:** This house is located near Stehekin Landing on the east shore of Lake Chelan. It is significant as an example of pre-World War II residential architecture and for its association with recreation in Stehekin. It is outside the project action area for the alternatives.
- **Golden West Lodge Historic District:** See “Cultural Landscapes.”
- **Harlequin Bridge:** Located approximately 4.5 miles northwest of Stehekin Landing, the bridge was determined eligible for listing on February 17, 1995. It provides access to private residences and NPS facilities along Company Creek Road on the south side of the Stehekin River. Built by the U.S. Department of Agriculture in 1948, it replaced an older bridge destroyed that year in a flood. The bridge’s rare Baltimore truss design and timber construction were cited by the Washington State Historic Preservation Officer as contributing to its eligibility (NPS LACH 1995a:207). Harlequin Bridge is outside of the project action area for all alternatives.
- **High Bridge Ranger Station Historic District:** See “Cultural Landscapes.”
- **Stehekin Ranger Station Residence and Woodshed (Purple Point):** These buildings are significant for their association with the USFS era of land management in the North Cascades and are excellent examples of USFS residential architecture from the late 1920s. After the original ranger station was destroyed by rising lake waters, the station was rebuilt at its current location at Purple Point. Later a warehouse and bunkhouse (which have now been

substantially altered) were added. The ranger station is currently used for NPS housing and is outside the project area for the alternatives.

- **Stehekin School:** In 1921, Stehekin residents assembled to identify a site for a new school. Materials for the log building were crafted by Stehekin Community volunteers, funds were raised through "box socials" for flooring, windows, and doors, and construction began in late summer. Previous to this, various other log cabins served as schools. The old Stehekin School is significant for its association with the early settlement and development of the Stehekin Valley (NPS LACH 1995a:206). The Stehekin School is adjacent to the project action area and would not be affected by the alternatives.

## Cultural Landscapes

The following reports and inventories document cultural landscapes:

- List of Classified Structures Update (2005);
- High Bridge Ranger Station Cultural Landscape Inventory (2002);
- Buckner Homestead Cultural Landscape Inventory (1984); and
- Golden West Lodge Cultural Landscape Inventory (1985).

Evaluation of cultural landscapes is divided into the following categories, which recognize contributing resources:

- **Spatial organization**—the composition and sequence of outdoor spaces within the district;
- **Circulation**—the means and patterns of movement through the district;


Photo 22 – Historic Old Stehekin School (Michael Silverman).

- **Topography**—the ways in which the landscape planning responds to the topographic features of the site and the modifications of that topography;
- **Vegetation**—the response of existing vegetation as well as the management of vegetation through pruning, removal, or addition of trees and shrubs;
- **Structures**—all contributing structures, including roads, trails, and other small-scale features such as rock walls and culverts; and
- **Buildings**—structures intended to shelter a human activity.

Three areas within Lake Chelan are managed as cultural landscapes: the Golden West Lodge Historic District, Buckner Homestead Historic District, and the High Bridge Historic District. The High Bridge Historic District is within the project area but not within the area of potential effects. A Cultural Landscape Inventory, completed prior to certification requirements, is available for the Buckner Homestead (Kennedy pers. comm. 2008), as is the Buckner Orchard Homestead Historic District Final Management Plan (NPS 1998b).

**Golden West Lodge Historic District:** The district consists of seven contributing structures built on a four acre site to provide a wilderness resort. It is the oldest large-scale resort in North Cascades NPS Complex and the only remaining example of large-scale resort development in the North Cascades. A cultural landscape inventory is available for this district (Kennedy pers. comm. 2008).

When the early Field Hotel at the head of the lake was dismantled in 1926, the building materials were salvaged and used in the construction of the Golden West Lodge. After World War II, the lodge was expanded and five rustic cabins, a small swimming pool, fish pond, shuffleboard court, and other landscape features were added (NPS LACH 1995a:204). Restoration of the Golden West Lodge has retained its historic character. Inside it has a bookstore, information desk, exhibits, and an open activity area. On the second floor are offices and storage space. Restrooms are located both upstairs and downstairs. The Golden West Lodge Historic District is not within the project area for the proposed alternatives.

**Buckner Homestead Historic District:** This district comprises 15 buildings, other structures, and ruins, as well as orchards, pasture, and hand-dug irrigation ditches, on approximately 90 acres. It is the largest group of structures representing the early settlement of the Stehekin Valley over the six decades from 1889 to the 1950s (NPS LACH 1995a:203). Among the outbuildings include a brooder house, chicken coop, root cellar, barn, milk separator house, two sleeping cabins, and sheds.

The original log cabin on the site was owned by William Buzzard, who mined in Horseshoe Basin. It was originally the farthest homestead up the Stehekin Valley. Sold to William Van Buckner in 1910, it evolved from a single cabin into an intricate complex, including structures, paths, irrigation ditches, and fruit orchards, that contributes significantly to understanding homesteading in this wilderness region. It is the only example of an existing intact homestead complex in North Cascades NPS Complex (NPS LACH 1995a:204).

The Buckner Homestead hayfield and pasture plan states that the management direction for rehabilitation is to "preserve the character-defining features of this unique resource while allowing compatible use" (NPS 1998b). This area, the hayfield and pasture, is within the project action area.

# 11. Visitor Experience

Since the late 19th century, large numbers of outdoor enthusiasts have been drawn to the North Cascades for physical and mental challenge, rest and relaxation, and enjoyment of scenic grandeur. Visitor use in the Stehekin Valley is generally concentrated in the lower nine miles. Sightseeing, fishing, hunting, boating, horseback riding, and mountain climbing have been among the most favored activities (NPS LACH 1995a:204). Other activities include hiking, bicycling, tours, photography, camping, and rafting.

Approximately 38,500 people annually visit Stehekin, arriving on one of two commercial passenger boats, on foot, or by air on one of two recently available chartered floatplanes. Stehekin residents (including NPS employees) also depend on the boats for visitors, mail, groceries, and freight. A commercial barge provides services intermittently (about every ten days in summer and once a month during the rest of the year) to haul vehicles, fuel tanks, building materials, and other bulky freight items.

## Access and Transportation

The north end of Lake Chelan and the village of Stehekin serve as a gateway to the interior of the Lake Chelan NRA, Stephen T. Mather Wilderness, and North Cascades National Park. This is one of the few entry points on the southern end of North Cascades NPS Complex that is readily accessible to visitors. Similarly, the Stehekin Landing and the Stehekin Valley Road form the main route from this gateway. Thus, the Stehekin Valley Road is the primary access route for recreation and is an integral part of the visitor experience in this area. In 2003, over 70 percent of the visitation occurred during the summer season, between June and September, which continues to be consistent with ridership statistics for the ferries. Visitation between 1996 and 2009 is shown in Table III-13: *Visitation to Lake Chelan NRA*.

The Stehekin Valley Road was built on the north side of the Stehekin River in 1897 to provide access to mines located in Horseshoe Basin (3.4 miles above Cottonwood Camp). Prior to the 1995 flood, shuttles took visitors to Cottonwood Camp. Beginning in 1995, the road became impassible above the Glory turnaround. Following flooding in 2003, which made the road impassible to vehicles between Car Wash Falls and Bridge Creek and caused a major landslide at Milepost 15.0, an Environmental Assessment was prepared (NPS NOCA 2006c) which called for closing the upper Stehekin Valley Road to motor vehicles at Car Wash Falls (Milepost 12.9), approximately three miles above High Bridge. As a result, that portion of the road was officially closed in 2006.

Visitors and residents travel by passenger ferry, floatplane, or trail to the Stehekin Valley from Chelan or other ferry landing areas (Fields Point and Lucerne). Motorists, cyclists, hikers, stock users, and snowmobiles are allowed on the Stehekin Valley Road, and most also use the Company Creek Road. Vehicle traffic along the Stehekin Valley Road includes NPS and resident vehicles, private and power company vehicles, and shuttle buses.

Most visitors arrive on the Lady of the Lake, a 350-passenger commercial ferry that runs between Chelan and Stehekin. The boat ride takes about four hours one-way. Another, faster, ferry, the 100-passenger Lady Express, is also available and takes approximately two hours one-way. Both leave from Chelan and, depending on the boat, stop at Lucerne and/or Fields Point en route.

Taking the fast boat uplake and the slow boat downlake allows day-use visitors to spend approximately 3.5 hours in Stehekin. With the slow boat each way, a day-use visit is closer to two hours, which is enough time for a quick guided bus tour to Rainbow Falls and a stop at the visitor center before boarding for the return trip. Both boats offer a Rainbow Falls bus tour that starts just after the boats arrive at the Landing.

In 1991, 59 percent of visitors used the four-hour boat, 38 percent used the two-hour boat, 16 percent came or left on a private boat, nine percent used a floatplane, and six percent hiked in or out (NPS LACH 1995a:234). In 2007 (January - September), approximately 17,742 people came by boat (16,680 or 94 percent) or on the float plane (1,062 or six percent).

Access up the Stehekin Valley is via the Stehekin Valley Road, which is paved up to Harlequin Bridge. At Harlequin Bridge, the road narrows considerably and turns to gravel with strategic pullouts. Traffic is generally light, with a few private, government, and shuttle vehicles traveling upvalley to the Stehekin Valley Ranch (near Milepost 9.0).

Company Creek Road, which begins at Harlequin Bridge, is a 2.2-mile-long spur road. In addition to providing access to the current NPS maintenance area, airstrip, gravel pit, Chelan PUD power plant, and private homes located on the northwest side of the Stehekin River, it provides access to some visitor facilities, including Harlequin Campground and the Stehekin River Trail, Devore Creek Trail, and Company Creek Trail.

There is also a state-maintained emergency airstrip located in Stehekin about four miles from the Landing on Company Creek Road. It is operated by the Washington State Department of Transportation Aviation under a special-use permit from the NPS. The airstrip, which is 2,630 feet long and 100 feet wide, is used for emergencies and by residents and visitors. WSDOT Aviation also identifies it for recreational use, firefighting, transportation access to a remote community, and flight safety enhancement, however, the NPS agreement cites it as an emergency airstrip. Consistent with its intent as an emergency-use airstrip, it posts a "use at your own risk" statement. It is classified as a basic utility airstrip, able to be used by at least 75 percent of the single-engine and small twin-engine aircraft commonly used for business and recreation purposes. Cable tie-downs can accommodate up to six aircraft at one time. Reflective markers line both sides and identify the ends of the airstrip. An unlighted wind sock and a segmented circle made of painted rocks are the only navigational aids at the airstrip (NPS LACH 1995a:223, 229).

## Visitation

As discussed in the GMP, visitors come to Stehekin primarily from the western United States, with 75 percent from Washington and Oregon and six percent from California, mostly (42 percent) in groups of two and with immediate family members (61 percent). About one percent of visitors were from other countries (primarily Canada). Nearly half were between 30 and 50 years old, 17 percent were over 60, and 16 percent were under 16. About 68 percent were first-time visitors (NPS 1992b in NPS LACH 1995a:234).

Annual visitation to Stehekin varies. Average visitation between 1996 and 2006 was 40,457 (Table III-13: *Visitation to Lake Chelan NRA*). Visitor numbers have risen and fallen over the past 15 years, likely due to a host of factors related to the economy and tourism.

**Table III-13: Visitation to Lake Chelan NRA**

| Year | Visitation |
|---|---|
| 1996 | 36,891 |
| 1997 | 34,300 |
| 1998 | 45,779 |
| 1999 | 50,087 |
| 2000 | 51,825 |
| 2001 | 42,547 |
| 2002 | 40,590 |
| 2003 | 35,549 |
| 2004 | 42,529 |
| 2005 | 29,783 |
| 2006 | 35,151 |
| 2007 | 34,665 |
| 2008 | 25,139 |
| 2009 | 34,554 |

*Source: http://www2.nature.nps.gov/stats/ (NPS NOCA 2008b:205).*

Visitors come to experience the scenery and natural setting (78 percent), solitude, and access to wilderness, as well as other parts of the Lake Chelan NRA experience, including for wildlife, recreation/sports, and Stehekin Community, history and culture, among other reasons.

Visitation varies dramatically with the season, with sharp spikes between May and September and dramatic drops in the shoulder seasons (April and October) and fairly flat numbers at other times of year (November through March).

Of those who visit Lake Chelan NRA and Stehekin, approximately 63 percent are day-use visitors and 26 percent stay overnight. Of the day-use visitors, many stay for a very short period between boat landings and departures. For those who stay overnight, there are a variety of public camping, concession lodging (Stehekin Landing Resort), and private rental cabins; homes; a guest ranch; and several bed and breakfasts.

### *Stehekin Residents*

Approximately 100 people live in Stehekin year-round, with that number increasing to approximately 180 people during the summer. Residents include families who have lived in the valley for generations, as well as recently arrived homeowners. At the time of the GMP (1995), approximately one-third of the year-round residents were employed by the NPS or a concessioner, with today's numbers similar or only slightly lower.

## Interpretation and Education

The park administrative operations headquarters is located at Stehekin Landing in the rehabilitated Golden West Lodge building, which also serves as the recreation area visitor center. Interpretive programs, including evening programs, talks, and walks are offered daily during the peak season and on weekends during the shoulder seasons. The visitor center is also staffed regularly.

Three interpretive trails allow self-guided tours for visitors: the Imus Creek Trail, McKellar Cabin Trail, and Buckner Lane. Wayside exhibits at the Landing, along the Stehekin Valley Road, Rainbow Falls, and at High Bridge also assist visitors in learning about the area. Visitors also learn about the area on the ferry ride, from bus tours, and from Stehekin residents.

## Visitor Use Opportunities

### *Facilities*

In addition to the visitor center, visitor use facilities in Lake Chelan NRA include overnight lodging, a restaurant, general store/gift shop, marina, craft store, and a bakery/deli. Except for the bakery, the other facilities are clustered around the Stehekin Landing. Just upvalley from the Landing are bicycle and kayak rentals. Approximately nine miles up the Stehekin Valley Road is the Stehekin Valley Ranch, which offers a family-style dinner, lodging, guided backpacking, bicycle rentals, rafting, and horseback riding. While most facilities are seasonal, operating only during the summer months, some operate year-round to accommodate winter visitors and the approximately 100 year-round residents.

### *Activities*

Visitors can enjoy a variety of recreational activities, including traveling by passenger ferry, floatplane, or trail into Stehekin, where the Stehekin Community is recognized as contributing to the visitor experience. Once in the Stehekin Valley, they enjoy hiking, backpacking, camping, horseback riding, bicycling, windsurfing, whitewater rafting, kayaking, guided shuttle touring, snowshoeing, cross-country skiing, sightseeing, and nature trails. Some lodging accommodations offer the use of a car in the valley. Within Lake Chelan NRA and surrounding USFS land, hunting also comprises a small percentage of resident and visitor activities, particularly in the fall.

**Picnicking:** Picnicking is available at Stehekin Landing, Purple Point, and Harlequin campgrounds within the project area, and at High Bridge and Tumwater campgrounds outside the project area.

**Bicycling:** Bicycle use on roads is permitted within Lake Chelan NRA. Bicycles can be rented in Stehekin or transported to Stehekin on the boats.

**Horseback Riding:** Horse use is permitted on the Pacific Crest Trail and day rides are offered from the Stehekin Valley Ranch. Other trails also allow horseback riding.

**Rafting:** There is one formal raft launch downstream from Bullion Campground. Another informal river access point is available along the sandy shore of Harlequin Campground. Other river access point locations vary, mostly on sandy beaches along the Stehekin River, particularly near the mouth.

**Camping:** Several first-come, first-served walk-in campgrounds (some also accessible by vehicles) exist in the Stehekin Valley below High Bridge. These include Bullion Camp, Harlequin Camp, Purple Point Camp, Purple Point Horse Camp, and outside the project area, High Bridge and Tumwater camps. Groups are accommodated at Harlequin Camp, except during flooding, when they are diverted to Purple Point or the overflow area if it is available.

**Backcountry Camping:** Free permits are available for backcountry camping. No permits are required for boat-in campgrounds or for USFS camps.

People enjoy the upper Stehekin Valley for its scenic beauty and recreational opportunities. The lower Stehekin Valley Road gives the visitor glimpses of the glacier-tipped peaks and cirques and towering rock cliffs. Glimpses of the river through the forest and alongside the road are available periodically. High Bridge Historic District, with its early 1920s Forest Service ranger station, is an attraction for visitors and residents. The Stehekin River at High Bridge cuts dramatically through a bedrock box canyon with steep walls. The road bridge is high above the clear whitewater. The district has become a destination for tour groups and has been a summer shuttlebus turnaround highlight over the past few years.

At High Bridge, the Stehekin Valley Road provides access to the Pacific Crest Trail, other trailheads, fishing, and camping. Since the 2003 flood, access to recreational opportunities

Photo 23 – Riding to Coon Lake (Hapner).

beyond High Bridge has mostly been by hiking or horseback riding. Visitors can also bicycle or drive only as far as Car Wash Falls, approximately a half mile above High Bridge.

**Commercial Services:** Of the 36 private businesses known to operate in the Stehekin Valley, at least 23 provide visitors services in Lake Chelan NRA and/or North Cascades National Park. Based on self-reporting data provided to the NPS in 2011, six of the businesses that operate with a Commercial Use Authorization on NPS land served approximately 2,900 visitors to Lake Chelan NRA that year. Considering the additional 17 visitor-service-oriented businesses in the Valley, it is likely that the total amount of visitors served by private business in Lake Chelan NRA is much higher.

### *Trails*

Among the short trails that are used by many visitors in Stehekin include the interpretive Buckner Lane, Imus Loop Trail, Rainbow Loop Trail, and Lakeshore Trail. Longer trails include the Company Creek Trail, Stehekin River Trail, Rainbow Lake Trail (including spurs to McAlester Lake and Creek), Boulder Creek Trail, McGregor Mountain Trail (Coon Lake), Purple Creek Trail (Juanita Lake), Devore Creek Trail, Park Creek Trail, Cascade Pass Trail, and the Pacific Crest Trail (Agnes Gorge Trail (south) and Bridge Creek Trail (north)).

The National Trails System Act, signed by President Lyndon B. Johnson in 1968, created the Pacific Crest and Appalachian National Scenic Trails. National Scenic Trails are "extended trails so located as to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass." Although outside the project area, the Pacific Crest Trail is accessed from the end of the Stehekin Valley Road.

Photo 24 – Windsurfer on Lake Chelan.

## Safety

Floods may create safety concerns for people using the Stehekin Valley Road. Currently, it can take from several hours up to half a day to warn residents and visitors about possible road flooding. Floodwaters generally rise fairly slowly and high ground is available in many areas within a short distance of the Stehekin Valley Road (generally within 0.5 mile).

The National Weather Service is preparing a flood warning system for the Stehekin Valley (NPS LACH 2005). Road construction projects are by nature inherently hazardous to workers involved in the project and to recreation area visitors. Workers must have adequate training and knowledge, particularly in traffic safety operations as well as those associated with their individual areas of expertise, to effectively carry out their job. In a national park this knowledge must include familiarity with the terrain and park resources affected by the project and how these resources might respond to disturbance (including tree falling, rock fall, slumping, etc.). Although recreation area visitors must be aware of road hazards on a continuous basis, road construction areas are particularly hazardous, especially when implemented in scenic terrain. Visitors may be unaware of the road construction project and may come upon it suddenly, while focused on viewing scenery or wildlife. They may be unprepared for or become bothered by long delays during one-lane closures. Some are unfamiliar with the nature of historic, winding park roads, which often contain few of the traffic devices normally encountered in steep mountainous terrain, such as guard walls, reflectors, and sudden or sharp curve signs.

## Scenic Resources

Lake Chelan NRA is a powerful landscape that includes one of the deepest lakes in North America, thundering waterfalls, spectacular spring dogwood blooms, and the scenic beauty of the free-flowing Stehekin River. Towering peaks surround the valley and are graced by glaciers. Ancient human occupation of this major mountain valley is marked by pictographs and stone artifacts, while current seasonal cabins and homes are dispersed through forests, pastures, and the historic Buckner Homestead. The legislation establishing Lake Chelan NRA specified conservation of scenic resources as one of the primary reasons for its establishment.

The 1995 GMP included a detailed inventory of visual and scenic resources (NPS LACH 1995a:206 - 218). In summary, 16 different landscape types were identified in the valley from Geographic Information System analysis of topography and vegetation. In addition, 21 different key viewpoints were inventoried based on interviews with park staff, visitors, and valley residents.

# 12. Wild and Scenic Rivers

This section describes the characteristics of the Stehekin River that contribute to the river's eligibility for listing as a component of the National Wild and Scenic Rivers System. It is based on the *Stehekin River Wild and Scenic River Eligibility Report* (NPS 2002b) and is adapted from the discussion of Wild and Scenic Rivers in the Stehekin Valley Road Improvement Project EA (NPS LACH 2005a). Information from the Eligibility Report is also used to evaluate potential impacts of the proposed project on its eligibility for inclusion in the National Wild and Scenic Rivers System.

The Stehekin River and its tributaries have been determined eligible for, but have not been designated as part of the Wild and Scenic Rivers System. In addition, neither the Stehekin River nor any of its tributaries are part of the Washington State Scenic Rivers System. Therefore, currently the only way the river could be included in the system is via affirmative congressional action, and no action is believed pending or contemplated by Congress as of this writing.

In 2002, the NPS evaluated the Stehekin River and its tributaries for its eligibility for inclusion in the National Wild and Scenic Rivers System, and determined that the entire watershed of the Stehekin River is eligible for designation (NPS 2002b). The eligibility analysis was prompted by management guidance in the 1995 GMP for Lake Chelan NRA, and the miscellaneous provisions of a 1991 Consent Decree[1] between the Secretary of the Interior and the North Cascades Conservation Council. A brief summary of the eligibility report follows, along with its implications for river-related management actions on the part of the NPS.

The eligibility analysis used two criteria to evaluate the river's eligibility in accordance with the Act: (1) the "Free-flowing" condition of the river; and (2) the river's "Outstandingly Remarkable Values" (ORV) including fish, wildlife, vegetation, prehistoric and historic resources, geology, scenery, and recreation. The "Free-flowing" criterion was evaluated by dividing the river into three segments in light of differences in human activity and development along its shoreline. Segment one extends from the mouth of the Stehekin River to High Bridge (the segment within Lake Chelan NRA); segment 2, from High Bridge to Cottonwood Camp (within North Cascades National Park); and segment 3, from Cottonwood Campground to the headwaters (also within North Cascades National Park). To evaluate the "ORV" criterion, all three segments were considered collectively.

All three segments of the Stehekin River were determined to be eligible for inclusion in the Wild and Scenic Rivers System due to the river's generally free-flowing condition and outstandingly remarkable values, including wildlife, fish, prehistoric, historic, geologic, scenic, and recreational resources. The river's vegetation, however, was found to be exceptional but not sufficiently unusual to contribute to eligibility.

The Stehekin River Eligibility Report places the Stehekin River in the category of an "Agency Identified, 5(d)(1) Study River." This administrative determination carries no direct legal authority, but does lay the foundation for future designation of the river should the U.S. Congress choose to do so. The eligibility finding does, however, influence NPS management actions that could potentially affect the river's free-flowing characteristics or the various "Outstandingly Remarkable Values" that contribute to its eligibility. In accordance with guidance from the Interagency Wild and Scenic Rivers Coordinating Council, and Section 4.3.4 of NPS *Management Policies 2006*, the NPS must avoid taking management actions that would adversely affect the free-flowing condition and "Outstandingly Remarkable Values" that qualify the river for inclusion in the National Wild and Scenic Rivers System.

### *Classification of the Stehekin River under the Wild and Scenic Rivers Act (WSRA)*

The WSRA defines three classes of national Wild and Scenic Rivers:

- **Wild river areas:** Those rivers or section of rivers free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and with unpolluted water. These represent vestiges of primitive America.

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1 *A judgment whereby the defendant agrees to stop the activity that was asserted to be illegal, without admitting wrongdoing or guilt.*

- **Scenic river areas:** Those rivers or sections of rivers free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational river areas:** Those rivers or sections of rivers readily accessible by road or railroad that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Because levels of human activity and development are not uniform throughout the Stehekin River watershed, the eligibility report segmented the river to determine the appropriate classifications for each segment.

Segment one extends from the river mouth at Lake Chelan and ends at High Bridge, a length of approximately 11 miles, encompassing the proposed project area. Because of disturbance to the riverbank and the presence of houses, businesses, power lines, and other human development, the Eligibility Report recommended a classification of "recreational" for Segment 1. In Segment 1, the first quarter mile of the river's tributaries (except for Company Creek) from their confluence with the river would also be classified as recreational. The rest of those tributaries' lengths would be classified as wild. The first half mile of Company Creek would be classified as recreational. All tributaries above Segment one would be classified as wild.

Segment 2, which extends from High Bridge to Cottonwood Camp and is not within the proposed project area, was classified as "scenic" in light of very limited road accessibility and shoreline development.

Segment 3, also outside the project area, extends from Cottonwood Campground to the headwaters. This segment was classified as "wild" because except for a few trails it is completely undeveloped.

### *Wild and Scenic Characteristics of the Stehekin River*

The WSRA identifies the characteristics that qualify rivers as eligible for inclusion in the National System as a river or river segment that

- Is free-flowing, as determined by standards set by the Departments of the Interior and Agriculture; and
- Possesses one or more resources of outstandingly remarkable value to the region or nation, such as exceptional scenery, recreational opportunities, geology, fisheries, wildlife, prehistoric values, or cultural heritage.

#### Free-flowing

Free-flowing, as applied to "any river or section of a river," is defined in section 16(b) of the WSRA as

> *. . .existing or flowing in natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway. The existence, however, of low dams, diversion works, and other minor structures . . . shall not automatically bar its consideration for inclusion: provided, that this shall not be construed to authorize, intend, or encourage future construction of such structures within components of the National Wild and Scenic Rivers System.*

The Eligibility Report describes river flow in Segment one as primarily natural, with existing modifications that are well within the standards for a Wild and Scenic River. Segment one of the Stehekin River exhibits some level of channel modification or restriction, but the intrusions are generally unobtrusive and of short length. Existing channel modifications intended to protect the main road or private property include the then-estimated 80 erosion protection structures, such as cabled logs, rip-rap, rock barbs, or a combination of structures, at 35 sites in Segment 1. A vehicular bridge spanning the Stehekin River above Harlequin Campground also alters the channel. Some tributaries flowing into Segment 1, such as Company Creek, are also crossed by vehicular bridges. Several tributaries also have intakes for small irrigation systems. The report notes that these intakes have very little impact on streamflow.

### Outstandingly Remarkable Values

All three segments of the Stehekin River exhibit outstandingly remarkable values as discussed in the Eligibility Report. The outstandingly remarkable values identified in the report include wildlife, fish, prehistoric resources, historic resources, geology, scenic resources, and recreation.

The Stehekin River and its valley support a great diversity of game and nongame wildlife and fish species, and provide or potentially provide habitat for many species of special interest, including threatened and endangered species. Many of these species are dependent upon the Stehekin River for some or all of their life cycle and the river is an important habitat component and migration route. Thus, fish and wildlife are outstandingly remarkable values associated with the Stehekin River.

Where there is evidence of prehistoric resources (occupation or use by Native Americans) in the river or river corridor and these resources have rare or unusual characteristics or exceptional human-interest value, then these constitute an outstandingly remarkable value. Since the early 1980s, NPS inventoried approximately five percent of North Cascades NPS Complex (684,000 acres). Even though only a relatively small area has been surveyed, over 250 pre-contact archaeological sites have been documented, with 12 of these in the Stehekin River Valley. These are resources associated with Native Americans before the time of contact with European settlers (approximately 1850). There are 33 archaeological sites recorded in Lake Chelan NRA; of these sites, 25 are prehistoric. Flake tools and unmodified flakes dating to 3,000 years ago have also been found in this area. As a result, the abundance and importance of the prehistoric resources in the Stehekin Valley qualify as an outstandingly remarkable value under the WSRA.

Historic resources include several sites listed in the National Register of Historic Places, and several more sites that are eligible for nomination. As a result, historic sites or features generally over 50 years in age that signify an important event, person, or cultural activity are categorized as an outstandingly remarkable value under the WSRA. The Stehekin River Valley contains three designated historic districts, which include log cabins, shelters, lookouts, mines, hostelries, and other structures built during the early exploration, settlement, commercial development, and federal management of the Stehekin Valley.

The geology of the Stehekin Valley includes excellent textbook examples of glacial features and processes, including glaciers, ice fields, cirques, spires, hanging valleys, and bedrock box canyons. The Golden Horn batholith is the only true granite found in the North Cascades and is a feature unique to the watershed. Therefore, the geology of the Stehekin Valley was found to be an outstandingly remarkable value under the WSRA.

Scenic resources include a landscape dominated by dramatic, glacially sculpted landforms, diverse vegetation, and exceptionally clear flowing water. Human impacts are few and unobtrusive and allow visitors to experience the grandeur of the wilderness. Though subjective, the quality of the scenery and natural landscape qualify scenic resources as an outstandingly remarkable value under the WSRA.

For a recreational resource to be considered an outstandingly remarkable value, it must be, or have the potential to be, unique enough to attract visitors from outside the geographic region to use the river resources for recreational purposes. This is true of the Stehekin River. Because of the difficulty in accessing the area (lack of vehicular roads into it), visitors must make extra arrangements to reach it. Stehekin Valley visitors come to sightsee, photograph, camp, hike, boat, and swim in / around the Stehekin River. Therefore, recreation resources qualify as an outstandingly remarkable value under the WSRA.

# 13. Park Operations

Approximately 20 - 35 NPS employees work in Stehekin during the summer (approximately ten year-round) to provide visitor services, conduct resource management and law enforcement, and maintain NPS administrative facilities, including roads, buildings, structures, and utilities.

Park operations activities include a variety of administrative activities, maintenance activities (roads, trails, orchard, historic structure, building, and housing), resource management activities (native and nonnative plant and wildlife management, fire/fuels management, research, inventory, monitoring, and restoration), and visitor services activities (search and rescue and other emergency services, interpretation, and visitor center operations).

When the project statement for the replacement and relocation of the maintenance facility was developed in 2000, Lake Chelan NRA contained 12.9 miles of roads, 128 miles of trails, 14 camping areas, 27 quarters structures, a trash-compaction/transfer station, 44 acres of maintained grounds, three National Historic Districts (with a total of 27 historic structures), 19 vehicles, six pieces of major equipment, two large boats, nine water systems (including two public ones), 15 septic systems, a wastewater treatment plant, 9,435 square feet of docks, and an 8,400-square-foot, three-story historic structure that serves as the district administration building / ranger station / visitor center.

## Roads and Bridges

### *Stehekin Valley Road*

The Stehekin Valley Road runs from the Stehekin Landing through the project area and continues into North Cascades National Park. It is approximately 12 miles long and is paved for the first four miles between the Stehekin Landing and Harlequin Bridge. North of Harlequin Bridge to the road end, the road is surfaced with gravel. In the project area, the paved road varies in width from 12 to 16 feet. The road is one lane, with various segments that have sight distance problems (both vertical and horizontal curves). Traffic volumes are light because there are few vehicles in the area (access to vehicles is limited because there is no direct access to Stehekin by vehicle unless the vehicle is brought in by barge). Most of the vehicles belong to residents or park concessioners (tour shuttles). NPS typically uses its own staff and vehicles (such as front-end loaders, graders, and dump trucks) to maintain the road.

NPS owns and maintains the road for Lake Chelan NRA. Annual maintenance may include filling potholes, grading the road, spreading gravel, and performing drainage work such as unclogging, replacing, or repairing culverts. To maintain the road during the winter, NPS hires a contractor who plows the road from the Stehekin Landing up to Milepost 9.2 so that access is maintained to this point. (Average monthly snowfall in Stehekin ranges from approximately 7-12 inches in March and November to 24, 40, and 44 inches in February, December, and January, respectively. Average annual snowfall is approximately 128 inches [Western Regional Climate Center 2004].)

The road is an important route for recreation area staff in accessing the Stehekin Valley. This road is used in emergency response such as fighting wildfires, transporting visitors out in an emergency situation (for example, if a hiker or camper were injured), or evacuating residents during floods. It is also used for more routine operations, such as implementing the Forest Fuel Reduction Program, performing resource surveys, providing assistance to visitors, and protecting and managing Lake Chelan NRA resources.

### *Company Creek Road*

The Company Creek Road was originally part of the Stehekin Valley Road. It is now used for access across the Stehekin River from the current Stehekin Valley Road.

Company Creek Road is a 2.2-mile-long, one-lane road with occasional turnouts and a crushed aggregate surface. It provides the only access to numerous private parcels, Harlequin Campground, the hydroelectric power plant, the NPS maintenance area, the Company Creek Gravel Pit, and the airstrip on the southwest side of the Stehekin River.

The Company Creek Road is plowed in winter. In the spring and fall it is often subject to flooding, particularly in its upper and lower portion, near the NPS maintenance area and Mileposts 2.1 - 2.2. Other portions of the road have received floodwaters in the last several major floods, with portions of the road being damaged or lost and rebuilt in place. The Lake Chelan GMP calls for maintaining the Company Creek Road in place.

### *Other Roads*

There is a network of minor roads off the Company Creek and Stehekin Valley Roads, including Buckner Homestead roads, Rainbow Falls access road, NPS maintenance area access roads, Company Creek Gravel Pit access roads, NPS housing roads, and roads around Stehekin Landing to access the Golden West Lodge and other nearby buildings, as well as numerous private access roads leading to residences and businesses.

### *Harlequin Bridge*

Harlequin Bridge is located approximately 4.33 miles up the Stehekin Valley, where it joins the Stehekin Valley Road and the Company Creek Road. It is approximately 75 feet long with average daily traffic of 50 - 75 vehicles. Routine inspections are coupled with formal bridge inspections occurring every two years. The bridge was last replaced in 2001. The rare Baltimore truss design and timber construction have contributed to make the bridge eligible for listing on the National Register of Historic Places (see “Historic Buildings and Structures” in “10. Cultural Resources”).

## Road Maintenance Activities

### *Winter*

Mechanical removal of snow occurs regularly in the winter on the Stehekin Valley Road to Milepost 9.2 and on the Company Creek Road. The Stehekin Valley Road is plowed from the Stehekin Landing up to the turnaround at Milepost 9.15. Snow removal reduces the hazards of winter driving conditions and ensures that Lake Chelan NRA roads are open to residents and visitors in winter. The roads are plowed from approximately November to March each year, depending on snow conditions. Snow- and ice-melt chemicals or sand is not used.

### *Spring*

Spring road-opening operations begin by April to ensure availability during the peak visitor use season (June to October). For nonpublic roads, work is done as needed or at the end of the public road opening. Road-opening activities include clearing roads of windfall trees and debris, clearing avalanches and rock slides, cleaning culverts, and minor repairs to the road surface, shoulders, and embankments.

### *Summer/Fall*

Road maintenance activities occurring during normally dry weather include grading unpaved road surfaces, shoulder maintenance, removal of sloughed material from ditches, pavement repairs and leveling, pothole patching, crack sealing, slurry sealing, repaving, sign installation, etc.

Unpaved roads are graded, reshaped, and smoothed, replacing surface material as needed (without widening) to restore crown, proper shape, drainage, and a smooth traveling surface. Maintenance includes pulling material from and cleaning roadside ditches and culverts and disposing of this material as needed. It also includes reshaping shoulders as necessary.

Unpaved road surface materials are often lost due to traffic, erosion during storms, and other predictable and unpredictable events. As-needed repair and stabilization of unpaved roads occurs by adding crushed rock to the road surface. To accomplish this, reshaping and compacting to control ruts, potholes, washouts, and corrugation may also be done.

On paved roads, patching of small areas of asphalt paving with cold, premix asphalt concrete to correct abrupt depressions, potholes, edge failures, and other potential road/parking surface hazards is undertaken to provide a smooth paved surface. Occasionally, permanent pothole patching is conducted with a premix asphalt concrete and asphalt emulsion (tack) to correct abrupt depressions, potholes, edge failures, and other potential road/parking surface hazards to provide a smooth paved surface.

Other maintenance actions include clearing road shoulders and parking ditches to enable rapid meltwater and rain dispersion off the road surface. This includes the cleaning and reshaping of roadside ditches along paved and unpaved roads and parking areas as well as the removal, hauling, and disposal of excess material to restore the original grade and to ensure adequate drainage. On occasion, it can include the importation of additional material. It also includes the trimming or removal of woody vegetation from roadside ditches and shoulders and the removal of overgrown herbaceous vegetation. These actions are done to eliminate or improve edge ruts, washouts, ridges, corrugation, and encroaching vegetation.

When pavement failures are encountered, these areas may be repaired by removing and replacing areas of failed surfaces with premix asphalt, including a base course, if required, to provide a structurally sound surface and to eliminate safety hazards from roads and parking areas. Work may include the placement of a new asphalt surface leveling course on asphalt-paved surfaces to provide a smooth driving surface and to eliminate safety hazards. Premix asphalt concrete is then applied with either a grader or a spreader box. Slurry seal or chipseal is applied as needed, and includes the placement of liquid asphalt with an aggregate or chipseal coat to seal cracks and prevent water entry and related damage to base course materials, to correct minor surface depressions, to seal asphalt surfaces, to restore skid resistance, and to retard further surface deterioration.

Day-to-day maintenance may also include the following:

- Sweeping paved road/parking surfaces, including intersections and curb gutters to remove dirt, sand, and other debris;
- Cleaning drainage structures by removing rocks, debris, and silt from pipe culverts, box culverts, and inlets to maintain adequate drainage and to prevent roadway flooding;
- Repairing pipe culverts, drop inlets, catch basins, and culvert headwalls to provide proper drainage;
- Cutting and removing brush, trees, and overhanging limbs along roads, in campgrounds, and in parking areas to maintain vistas and restore sight distances, to eliminate traffic hazards, and to remove encroaching vegetation;
- Picking up and disposing of litter along roads, at overlooks, and along/in parking areas for aesthetics and to remove objects that could be hazardous, could obstruct drainage, or could damage road maintenance equipment;
- Repairing slope failures and erosion near roads and developed areas and the removal of eroded material, including occasional reseeding, replanting, or installing mechanical erosion protection measures as needed to prevent such an occurrence from happening again in the same area;
- Removing rock fall and slide material from the roadway and roadsides;
- Cleaning road bridge decks and bearing surfaces to remove sand and other debris, including the cleaning of drain holes, joints, and curbs; and
- Repairing minor bridge components such as railing and decks.

### *Other Maintenance Activities*

Among the other activities necessary to keep NPS administrative facilities running include ongoing testing and maintenance of recreation area water and septic systems and the wastewater treatment plant; repairs to NPS buildings and structures, including offices, houses, docks, and other transportation facilities; extraction and sorting of rock and gravel from the Company Creek Pit; vehicle maintenance; resupply of materials and fuel; ongoing cleanup and maintenance of recreational facilities, including trails, campgrounds, and restrooms; and maintenance of landscaping, including mowing, snow removal, etc. Table III-14: *Existing Maintenance Compound Structures* shows how the existing maintenance area is currently configured.

**Table III-14: Existing Maintenance Compound Structures**

| Building | Square Feet | Condition* |
|---|---|---|
| Fire cache | 1,637 | Poor |
| Maintenance office | 660 | Good |
| Maintenance shop | 1,140 | Good |
| Solid-waste compaction / warehouse | 2,440 | Poor |
| Solid-waste platform | 875 | Serious |
| Hazardous waste storage | 144 | Unknown |
| Gas station | 800 (12,000) | Good |
| Paint / flammable storage | 256 | Unknown |
| Covered storage 1 | 1,008 | Good |
| Covered storage 1 | 1,008 | Good |
| Covered storage 1 | 1,008 | Good |
| Carpenter shop | 900 | Poor |
| Water system | n/a | N/A |
| Circulation space | 10,890 | N/A |
| Total | 11,876 (without circulation space) | |

**The NPS uses a ranking system to identify the condition of its facilities. Under this system, the combined average asset priority index is 52 out of 100; the combined average facility condition index is 0.220 (poor). Overall, the existing maintenance facility is costly to maintain, inefficient to operate, and subject to recurrent flooding, with access through floodwater occurring approximately every other year.*

## Shooting Range

There is a small shooting range on public land that is used by the NPS for firearms shooting practice and qualifying for Law Enforcement and other park operations programs. About 25 yards in length with four target boards, the shooting range is located in an old borrow pit. It is approximately 300’ from the Stehekin Valley Road, with a small access road leading to it. The shooting range is also used by Stehekin residents.

## Natural Resource Monitoring

### *Vegetation*

The NPS staff is currently conducting long-term ecological monitoring of selected forest types (Douglas-fir-western hemlock and subalpine fir) as well as alpine-subalpine vegetation to monitor potential changes resulting from global climate change. In addition, nonnative invasive plants are inventoried and mapped as funding allows and are actively removed annually. Special status plants are inventoried and mapped associated with surveys for proposed projects and management actions. Mushroom surveys are also ongoing. Inventory work has included general vegetation mapping, surveys for state-listed vascular plant species, and limited surveys for mushrooms and nonnative species.

### *Wildlife*

Annual long-term monitoring includes landbird surveys at five sites within the Stehekin Valley between the head of Lake Chelan and High Bridge. Periodic monitoring surveys also include Harlequin Duck surveys from High Bridge to the head of Lake Chelan (last done in 1992) and Spotted Owl Activity Site monitoring (last surveyed in 2011). The extensive upper and lower valley spotted owl surveys of 1993 - 1994 were repeated in 2007 - 2008. Faunal surveys that include small mammals and several species of reptiles, are also done periodically. The last of these surveys was completed in 1992. In 2009, the NPS completed a survey of potential nesting activity of Bald Eagles and Ospreys within the lower Stehekin Valley and along Lake Chelan within the NRA, as part of the new Federal Energy Regulatory Commission (FERC) license of the Lake Chelan hydroelectric project. No activity was observed; further monitoring will occur if suspected or known nesting activity is reported in this highly visible area.

### *Fish*

The NPS staff monitors spawning of cutthroat and rainbow trout in the lower Stehekin watershed (High Bridge to Lake Chelan). A number of index reaches (approximately ten to 12) will be identified and surveyed for trout redds (either by walking or snorkeling) several times each spring. Spawning is likely taking place in side channels and tributaries (particularly Company, Blackberry, and Margerum creeks). The purpose is to monitor trends in abundance of cutthroat and rainbow spawners. Results will be used to evaluate progress toward restoration of adfluvial/fluvial westslope cutthroat trout and management efforts directed at reduction of nonnative rainbow trout in the lower ten miles of the Stehekin River. Partial funding is provided by Chelan PUD under their FERC relicensing agreement.

### *Stehekin River*

Monitoring programs for the Stehekin River include river discharge, channel patterns, and large woody debris surveys. Inventory of Stehekin River features has included surficial geology, soils, vegetation, river and side channel habitats, and wetlands (Table III-15: *Stehekin River Inventory and Monitoring Programs*).

**Table III-15: Stehekin River Inventory and Monitoring Programs**

| Subject | Agency | Date/Length of Record |
|---|---|---|
| Monitoring | | |
| River discharge | USGS | 1911 - present |
| River channel patterns | NPS | 1906 - 2007 |
| Large wood accumulation | NPS | 1985, 2000, 2007 |
| Inventory | | |
| Surficial geology | NPS | 2005 |
| Soils | NPS | 1988 + new project |
| Vegetation | NPS | 1988 + new project |
| Main stream and side channel habitat | NPS | 1988 |
| Wetlands | NPS | 1988 |

## Restoration

Vegetation / habitat restoration in the recreation area occurs in response to need and funding. It may consist of collecting (gathering seed from native species near the proposed restoration site), scarifying (raking or creating roughness in compacted areas), site preparation (incorporating forest duff or topsoil / placing large woody debris), and seeding (scattering or broadcasting seed collected from native species in the vicinity of the site). Occasionally, plants may be propagated from seeds or cuttings collected from the proposed revegetation site (generally avoided due to the need for supplemental watering to establish the young plants) (Gempko pers. comm. 2009).

## Fire Management

There are currently 48 long-term fire-effects-monitoring plots located within the forest fuel reduction areas of the Stehekin Valley, which are used to track the progress and effects of prescribed fire and thinning as they are implemented through the North Cascades NPS Complex *Forest Fuel Reduction/Firewood Management Plan* (NPS NOCA 2005e). The NPS fire management team has been conducting prescribed fires and thinning to reduce hazardous fuels within the wildland-urban interface and to maintain the benefits of fire in a fire-dependent ecosystem. The fire-effects-monitoring plots document fuel loadings, tree mortality, species composition, and species abundance before and after thinning and prescribed fires, and monitor long-term changes through continued visits to the plots the first year, second year, and thereafter every five years following prescribed fire (Kopper pers. comm. 2009). There are three fire-effects-monitoring plots located along the proposed reroute of the Stehekin Valley Road. These plots are located in areas that have been thinned but have not yet been burned. They are used to identify the impact of fire management program actions on area forest habitat.

The monitoring plots are 50 by 20 meters and are marked in all corners by rebar stakes with metal tags. Each tag contains the plot code "FPSME2" followed by the individual plot number. The plots that could be affected by the proposed reroute in Alternatives 2, 3 and 5 include FPSME2-43, FPSME2-45, and FPSME2-46. The plots are located in the Douglas Fir/Ponderosa Pine forest community. This vegetation type typically includes a well-developed shrub and understory component. The most common shrubs are common snowberry (*Symphoricarpos albus*), pinemat manzanita (*Arctostaphylos nevadensis*), serviceberry (*Amelanchier alnifolia*), and white spiraea (*Spiraea betulifolia*). The understory is predominantly comprised of native perennial grasses, including bluebunch wheatgrass (*Psuedoroegneria spicata*) and pine grass (*Calamagrostis rubescens*) and various herbaceous species, including arrowleaf balsamroot (*Balsamorhiza sagittata*), hawkweed (*Hieracium sp.*), and lupine (*Lupinus sp.*).

## Road Safety

(See also: "Safety" in "11. Visitor Experience.")

In a road traffic safety study conducted in August 1991 (as described in NPS LACH 1995a:227), average daily traffic volumes on the Stehekin Valley Road and Company Creek Road ranged from 33 to 221 vehicles per day. Between 1986 and 1990, 20 accidents were reported. Most involved only minor property damage and were attributed to the narrow roadway and/or limited sight distance. Since 2003, there have been 11 documented vehicle accidents. None of these resulted in injuries or fatalities. Since 2003, there have also been 15 documented bicycle accidents which resulted in injuries.

# 14. Socioeconomics

According to the Council on Environmental Quality (40 CFR, Sec. 1502.15), the "Affected Environment" should describe only those resources that could be impacted by the implementation of the alternatives. In response to public comments on the DEIS however, this section on the socioeconomic environment includes additional information. After analyzing the resources described below, the NPS has determined that a number of these resources would not be impacted by the implementation of alternative actions in this plan. Resources that would not be impacted but which are nonetheless described below include: demographics (age, gender, race), housing (vacancy rate), transportation and access to and from the Stehekin Valley, communication infrastructure, utilities (electricity, water, sewer/septic, waste disposal), county development regulations, and service-based assets (post office services, education services, medical emergency response services, law enforcement, fire management and protection, and community organizations).

## Area of Influence

The primary area of influence for economic and social consideration associated with Lake Chelan NRA is the Stehekin Valley, which contains the unincorporated community of Stehekin, at the northern end of Lake Chelan. Accessible only by boat, floatplane, or trail (no road extends to this town from any direction), the closest incorporated city providing services and access to the area is Chelan, Washington, located 55 miles south of Stehekin at the southern tip of Lake Chelan. The City of Chelan is within a few hours of several major cities in Washington State, including Spokane, Yakima, and Seattle. The next closest large city to Lake Chelan NRA is Wenatchee, located 40 miles south of Chelan. Stehekin, Chelan, Wenatchee, and Lake Chelan NRA are located within Chelan County, Washington.

Chelan County describes Stehekin as, "a valley which has been recognized on a national scale for its remote, isolated setting, its rich pioneer heritage, its scenic grandeur, the subtle details of its beauty and its scope of recreational opportunities. For its people, the valley is an access to rugged back-country, it is a place to fish and hunt, it is a stopping point on a boat excursion, it is a place for a summer home, it is a place to visit on a two week vacation, it is a place to work, and more" (Chelan County 2009:8).

### *Note on Data*

While social and economic data is most readily available and reliably accurate at the county and regional levels, this analysis has sought to include local data when possible. Since the NPS is not charged with collecting demographic information about residents or property owners, information for this analysis has been gathered from the U.S. Census Bureau, Chelan County data sources, Stehekin residents, archives from the local library, and files from the NPS and other governmental agencies. U.S. Census Data presented in this analysis is derived from self-reporting surveys that are distributed to every household in America every ten years. Census data includes information on population totals (residency); age, gender, and race demographics; housing units; and housing vacancy/occupancy statistics.

U.S. Census Bureau data was gathered at the State (Washington), County (Chelan), and census block (Stehekin) levels. Within Chelan County, the U.S. Census Bureau delineates eight geographic areas known as Census County Divisions (CCDs), one of which is the Stehekin CCD.

These CCDs are comprised of smaller census units: census tracts, census block groups, and census blocks, which are each subdivisions of the previous unit. A census block is the smallest geographic area at which census data is available. While Chelan County used the Stehekin CCD (which includes Lake Chelan NRA and lands to the east and west of Lake Chelan, including Holden Village) for analysis in their 2000 Comprehensive Plan, for the purposes of this analysis, the NPS, when feasible, further subdivided the Stehekin CCD into its 88 separate blocks (in 2010) and included data only from the blocks which are located in Lake Chelan NRA and the Stehekin Valley. (Some of these blocks extend outside of Lake Chelan NRA along the northern edges of Lake Chelan.) For 2010, these include blocks 2000-2031, 2333-2335, 2338-2339, 2353, 2355-2356, and 2360 in Block Group 2, Census Tract 9601, Chelan County, Washington. For 2000, these include blocks 1044, 1052-1054, 1070-1072, 1991-1992, and 1996-1998 in Block Group 1, Census Tract 9601, Chelan County, Washington.

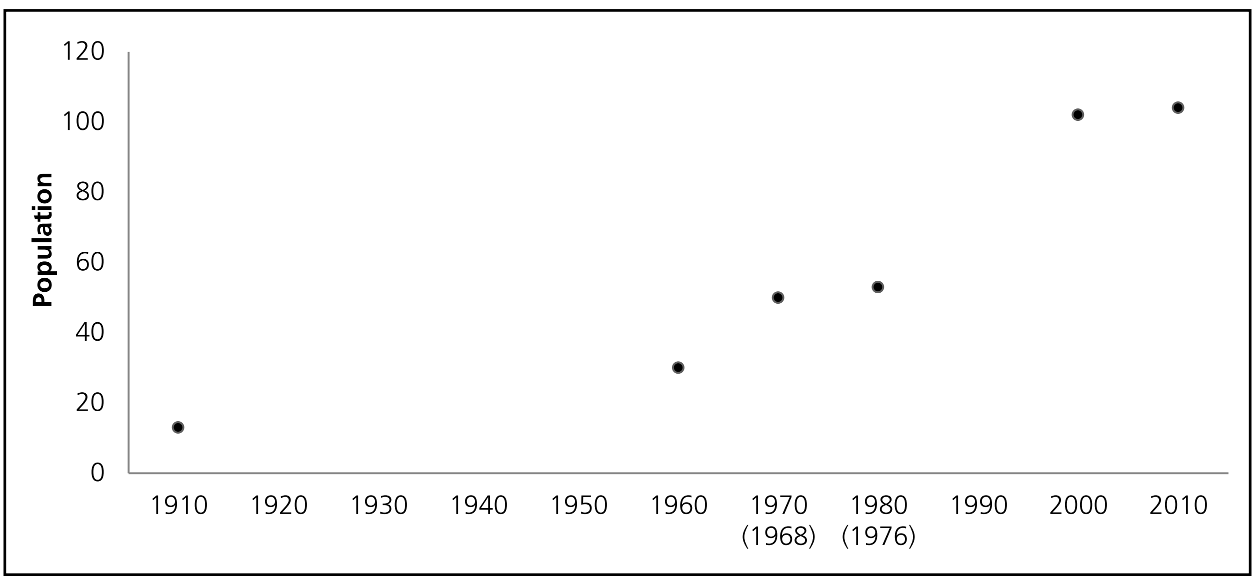
## Social Characteristics

### *Demographics*

#### Population

When Lake Chelan NRA and the rest of the North Cascades NPS Complex was established in 1968, Stehekin had a population of approximately 49 year-round residents, up from about 13 in 1910 (Wilsey and Fellows 1981; Robertson 1987, 12). Since the creation of Lake Chelan NRA, the population of this rural community has more than doubled in size. Today, approximately 104 people consider themselves residents of the Valley, a two percent increase in population since 2000 (Figure III-12: *Population Growth in Stehekin 1910-2010*).

**Figure III-12: Population Growth in Stehekin (1910-2010)**




*Sources: Robertson 1987; Georgette and Harvey 1980; Wilsey and Fellows 1981; NPS 1987; NPS 1976; U.S. Census Bureau 2000, 2010 (Table P1).*
*Note: The NPS could not find population data for year-round residents between 1910 and 1968. In addition, at the time this figure was created, the Census Bureau had removed the search element for the 1990 Census Data block level from the internet. Therefore this figure does not include census data from the 1990 census. Figure is meant to show a general pattern of growth in the Stehekin Community since the early 1900s.*

Disregarding seasonal increases in the population, the year-round community has grown by an annual 0.2 percent on average since 2000 (U.S. Census Bureau 2000, 2010). Chelan County projects that the entire Stehekin CCD (which includes Holden Village and has a population of 154 as of 2010) will grow by an additional 75[2] residents by 2030 (Chelan County 2009:19, U.S. Census Bureau 2010). The current density of Stehekin is estimated to be 13.8 persons per square mile (based on the non-wilderness acreage of the Stehekin Valley from High Bridge to the Stehekin Landing: 4,811 acres[3]) (U.S. Census Bureau 2010, Braaten pers. comm. 2012).

Although summer populations are not statistically measured in Stehekin, they have traditionally been double that of year-round residents. As early as the mid 1970s, the summer population in Stehekin was approximately 150 and was estimated to exceed 175 in 1997 (NPS 1976; NPS 1997).

As of the 2010 census, over 72,450 people reside in Chelan County, making it the 18th most populous county in the state (U.S. Census Bureau 2010). With a population of 66,616 in 2000, the county has grown faster than Stehekin over the last ten years, averaging a 0.9 percent annual growth rate (U.S. Census Bureau 2000, 2010). Today, the City of Chelan has a population of approximately 3,890 people; East Wenatchee has a population of 13,190 people; and Wenatchee, approximately 31,925 people. Due to the rural character of Chelan County and its public land (managed by the Department of Agriculture and the Department of the Interior), the county has a lower population density than the state (Table III-16: *Population Growth and Density in Stehekin, Chelan, and Washington (2000-2010)*) (U.S. Census Bureau 2010).

**Table III-16: Population Growth and Density in Stehekin, Chelan, and Washington (2000-2010)**

| Area | Population | | Pop. Growth 2000-2010 | Persons Per Square Mile (2010) |
|---|---|---|---|---|
| | 2000 | 2010 | | |
| Stehekin | 102 | 104 | 2.0% | 13.8 |
| Chelan County | 66,616 | 72,453 | 8.8% | 24.81 |
| Washington | 5,894,121 | 6,724,540 | 14.1% | 101.19 |
| *Sources: U.S. Census Bureau 2000, 2010 (Table P1), OFM 2012* | | | | |

## Age and Gender

Figure III-13: *Age Demographics in Stehekin by Age Group (2010)* shows Stehekin's age distribution across gender. As shown in this figure, Stehekin's population is evenly distributed between males and females (49 and 51 percent respectively). In addition, the figure shows that the community has a small young adult (20-24) population (1.0 percent of the total population) compared to other age groups (U.S. Census Bureau 2010).

*2 This projection is based on county population projections released by Washington State's Office of Financial Management (OFM) as part of the Growth Management Act. While the OFM released three projections for counties throughout the state: high, medium, and low in February 2008, Chelan County used only the OFM's high population projections in their 2000 Comprehensive Plan (amended in 2009). Chelan County, using these OFM high county projections, estimated population projections for Census County Divisions (CCD) (of which Stehekin is one) by distributing the 2030 projections to each of the eight CCDs in Chelan County based on the "historical trend of each CCD's percentage of the total county population"(Chelan County 2009:17-18). The County does not provide medium or low projections in this plan.*

*3 This acreage was calculated using ArcGIS 10.3. Using this software, the Stehekin Valley was isolated by creating a break-line at High Bridge (to exclude the non-wilderness corridor along the Stehekin Valley Road corridor above High Bridge and the Agnes Creek Valley) and at the lower end of the valley (to exclude Lake Chelan and its shores southeast of where the Stephen Mather Wilderness boundary dips to 50" about mean high water mark). ArcGIS then calculated the acreage within the resulting polygon (Braaten pers. comm. 2012).*

Photo 25 – Buckner Orchard Harvest Fest (Herb Sargo).

The median age of Stehekin's current year round population is 38.9[4], which is higher than that of Washington State (37.3) and lower than the median age in Chelan County (39.3). It has been stable since at least 2000 (U.S. Census Bureau 2000, 2010).

Today, 14.4 percent of Stehekin's population is 65 or older, and 39.7 percent of the workforce (ages 20-64) is within 15 years of retirement – many of who own a local business or work for the federal or state government (U.S. Census Bureau 2010). The NPS estimates that as much as 50 percent of the NPS staff in Stehekin fall into this category (Kurth pers. comm. 2011e).

Similar to other rural counties, Chelan County's median age is higher than the state, at 39.3, with 56.9 percent of the population between the ages of 20 and 64. Just over 15 percent of the county's population is 65 or older. Compared to Stehekin, a smaller percentage of Chelan County's workforce (36.8 percent) is within 15 years of retirement (U.S. Census Bureau 2010) (See Table III-17: *Age Demographics in Stehekin and Chelan County (2010)* for a comparison among Stehekin, Chelan County and Washington State).

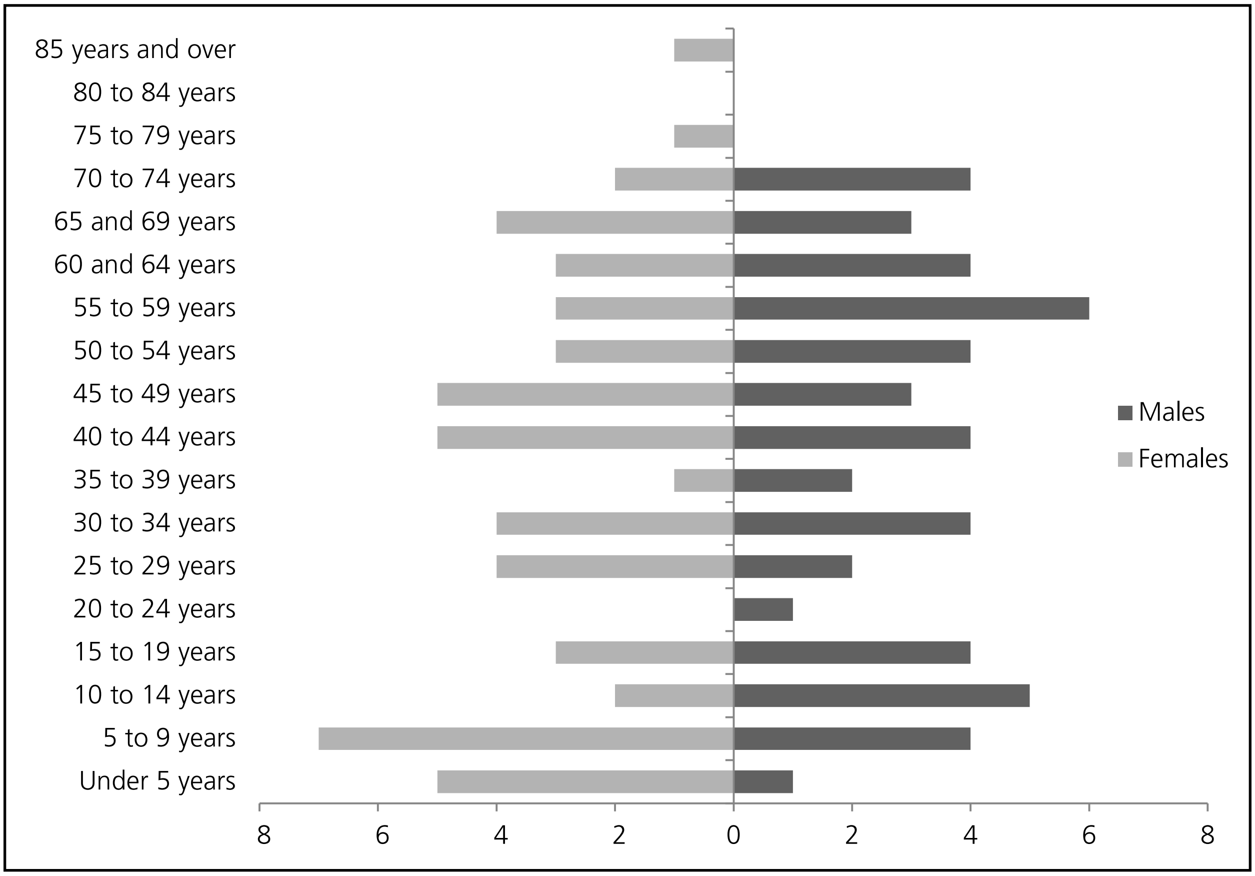
## Race

While 79.3 percent of Chelan County's population is white[5] (25.8 percent report Hispanic or Latino descent), Stehekin's population is decidedly more homogenous: 90.4 percent of the population is white (9.6 percent report Hispanic or Latino descent). In comparison, 77.3 percent of Washington State's population is white (11.2 percent report Hispanic or Latino descent) and 22.7 percent are of another race or ethnicity (which could include white if in combination with another race) (U.S. Census Bureau 2010) (See Table III-18: *Race Demographics for Stehekin, Chelan, and Washington (2010)* for a comparison among Stehekin, Chelan County and Washington State).

*4 Because this analysis depends upon U.S. Census data at the block level and because median age is calculated solely for each individual block, the median age for Stehekin was calculated for 2000 and 2010: the "total age" was calculated for each individual block by multiplying the block's median age and population. The "total age" from every block was then summed to calculate "Stehekin's total age." This number was then divided by Stehekin's population (the sum of population from all blocks) to calculate Stehekin's median age.*

*5 "White" in this is analysis is derived from the U.S. Census category "white alone," meaning it is not in combination with other races or ethnicities.*

**Figure III-13: Age Demographics in Stehekin by Age Group (2010)**




*Source: U.S. Census Bureau 2010 (Table P12)*

**Table III-17: Age Demographics in Stehekin and Chelan County (2010)**

| | Median Age | Percent of the Population in the Workforce (20-64) | Percent of the workforce within 15 years of retirement | Percent of the Population 65+ |
|---|---|---|---|---|
| Stehekin | 38.9 | 55.8 | 39.7 | 14.4 |
| Chelan County | 39.3 | 56.9 | 36.8 | 15.4 |
| Washington | 37.3 | 61.4 | 32.2 | 12.3 |

*Source: U.S. Census Bureau 2010 (Table P12 and P13)*

**Table III-18: Race Demographics for Stehekin, Chelan, and Washington (2010)**

| Area | White Population (%) (no other race) | One or More Races (%) (may include white) | Hispanic/Latino Population |
|---|---|---|---|
| Stehekin | 92.8 | 7.2 | 7.2 |
| Chelan County | 79.3 | 20.7 | 25.8 |
| Washington State | 77.3 | 22.7 | 11.2 |

*Source: U.S. Census Bureau 2010 (Tables P2 and QT-P5)*

### *Housing*

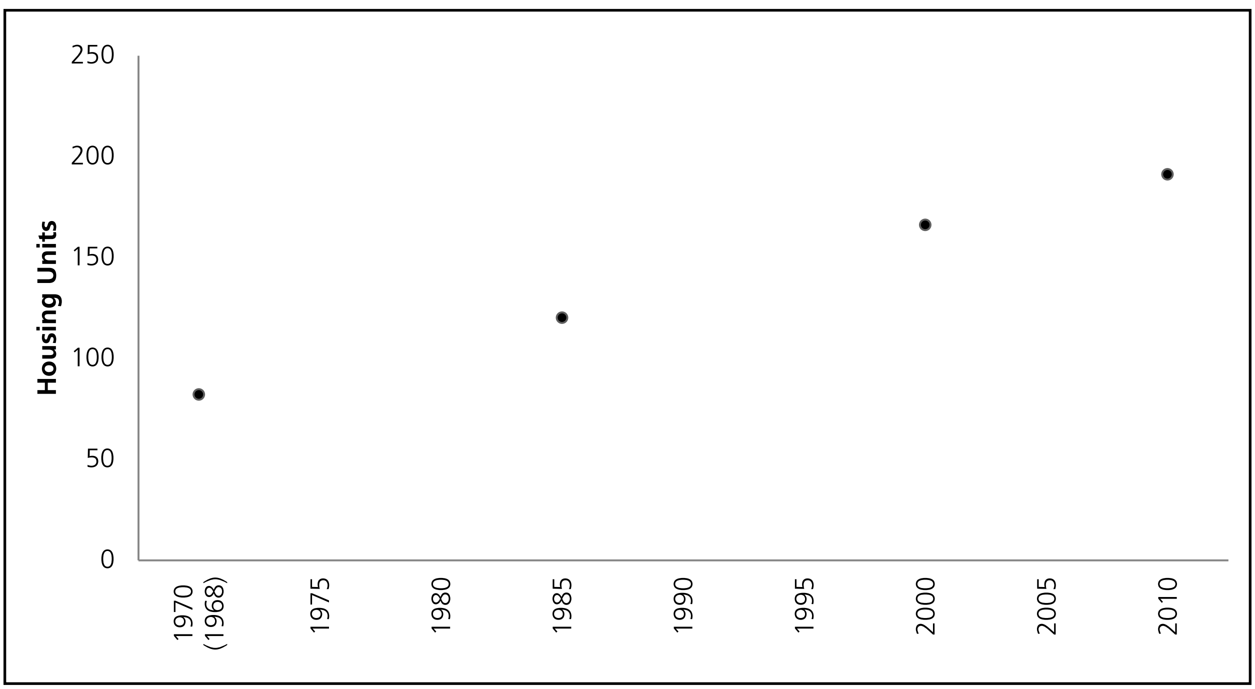
General Housing Characteristics

According to Georgette and Harvey (1980), there was very little development in the Stehekin Valley before 1968 when Lake Chelan NRA was established. With no more than half a dozen houses constructed between 1950 and 1960, Stehekin had approximately 82 residences when Lake Chelan NRA was designated by Congress in 1968 (Georgette and Harvey 1980; Wilsey and Fellows 1982). Later, according to Georgette and Harvey (1980:2-3):

> *"In the ten years since the creation of North Cascades NPS Complex, the Stehekin Valley has changed substantially. There has been a significant increase in visitation following the establishment of the complex, and the National Park itself, with its staff, facilities, and resource demands, has also greatly affected the Valley. The most striking change, however, has resulted from increasing private development in the Valley. Since 1968 the number of private residences in the Valley has nearly doubled, and the population has tripled…There is no sign, however that the development is slowing down; to the contrary, it is accelerating".*

As a result, there were about 120 residences in the Valley by 1985, 95 of these belonged to private landowners (79 percent) and 25 belonged to the NPS for use by the NPS or NPS concession (21 percent). At that time, approximately 40 residences were occupied year round; 30 occupied part of the year; and the remainder occupied only occasionally (NPS 1985). Based on this data, Stehekin had an estimated vacancy rate of approximately 66 percent in 1985 (Figure III-14).

**Figure III-14: Growth in Housing Units in Stehekin (1968-2010)**




*Sources: Wilsey and Fellows 1982; NPS 1985; Census 2000 (Table H1) and 2010 (Table H3)*
*Note: When this figure was created, the Census Bureau had removed the search element for 1990 Census Data at the block level. Therefore this figure does not include census data from the 1990 census. This figure is meant to show a general pattern of growth in housing units in the Stehekin Community since 1968 when Lake Chelan NRA was created.*

Today, according to the U.S. Census Bureau, there are 191 housing units in Stehekin, approximately 23 of which are owned and operated by the NPS (five of these are apartments that share a building with another unit, for a total of 20 buildings) (U.S. Census Bureau 2010; Slinde pers. comm. 2012) (Figure III-14: *Growth in Housing Units in Stehekin 1968-2010*). Based on analysis for the FEIS, there are approximately 170 structures located in the channel migration zone, including 96 houses and 72 outbuildings (Braaten pers. comm. 2011).

Compared to Chelan County, where the vacancy rate of all housing units is 21.5 percent (the remaining 78.5 percent of units are occupied year-round), Stehekin's current vacancy rate is high at 77.0 percent. That means 23 percent of the housing units are lived in year-round, while 77 percent of Stehekin's housing units are vacant at some point during the year. Most of these vacant units are used for seasonal, recreational, or occasional homes (91.8 percent of vacant units), while a small portion (8.2 percent) are for rent or for sale (not lived in at the time the 2010 Census was taken) or are otherwise deemed vacant (U.S. Census Bureau 2010). Both Stehekin and Chelan County experienced a 3.8 percent increase in the vacancy rate between 2000 and 2010 (U.S. Census Bureau 2000, 2010) (Table III-19: *Vacancy Rates in Stehekin and Chelan County (2000-2010)* and Figure III-15: *Occupancy in Housing Units in Stehekin and Chelan County 2000-2010*).

The owner-occupancy rate in Stehekin is low compared to Chelan County: 47.7 percent of the occupied units in Stehekin are owned by the resident, and the remaining 52.3 percent of the occupied units are occupied by those renting the unit. In comparison, 63.5 percent of the occupied units in Chelan County are owned by the occupant and only 36.5 percent are renter-occupied (U.S. Census Bureau 2010). While Chelan County experienced a 1.2 percent decrease in their owner-occupancy rate since 2000, Stehekin's owner-occupancy rate increased by 7.2

### Census Terminology

**Housing Unit:** "A house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Separate living quarters are those in which the occupants live and eat separately from any other persons in the building and which have direct access from the outside of the building or through a common hall" (U.S. Census Bureau, State and County QuickFacts).

**Vacant Housing Unit:** "A housing unit [where] no one is living in it at the time of enumeration, unless its occupants are only temporarily absent. Units temporarily occupied at the time of enumeration entirely by people who have a usual residence elsewhere are also classified as vacant" (U.S. Census Bureau 2011).

**For Seasonal, Recreational, or Occasional Use:** "Vacant units used or intended for use only in certain seasons or for weekends or other occasional use throughout the year. Seasonal units include those used for summer or winter sports or recreation, such as beach cottages and hunting cabins. Seasonal units also may include quarters for such workers as herders and loggers. Interval ownership units, sometimes called shared-ownership or time-sharing condominiums, also are included here" (U.S. Census Bureau 2011).

**Owner-Occupancy:** "A housing unit is owner-occupied if the owner or co-owner lives in the unit, even if it is mortgaged or not fully paid for" (U.S. Census Bureau, State and County Quick Facts).

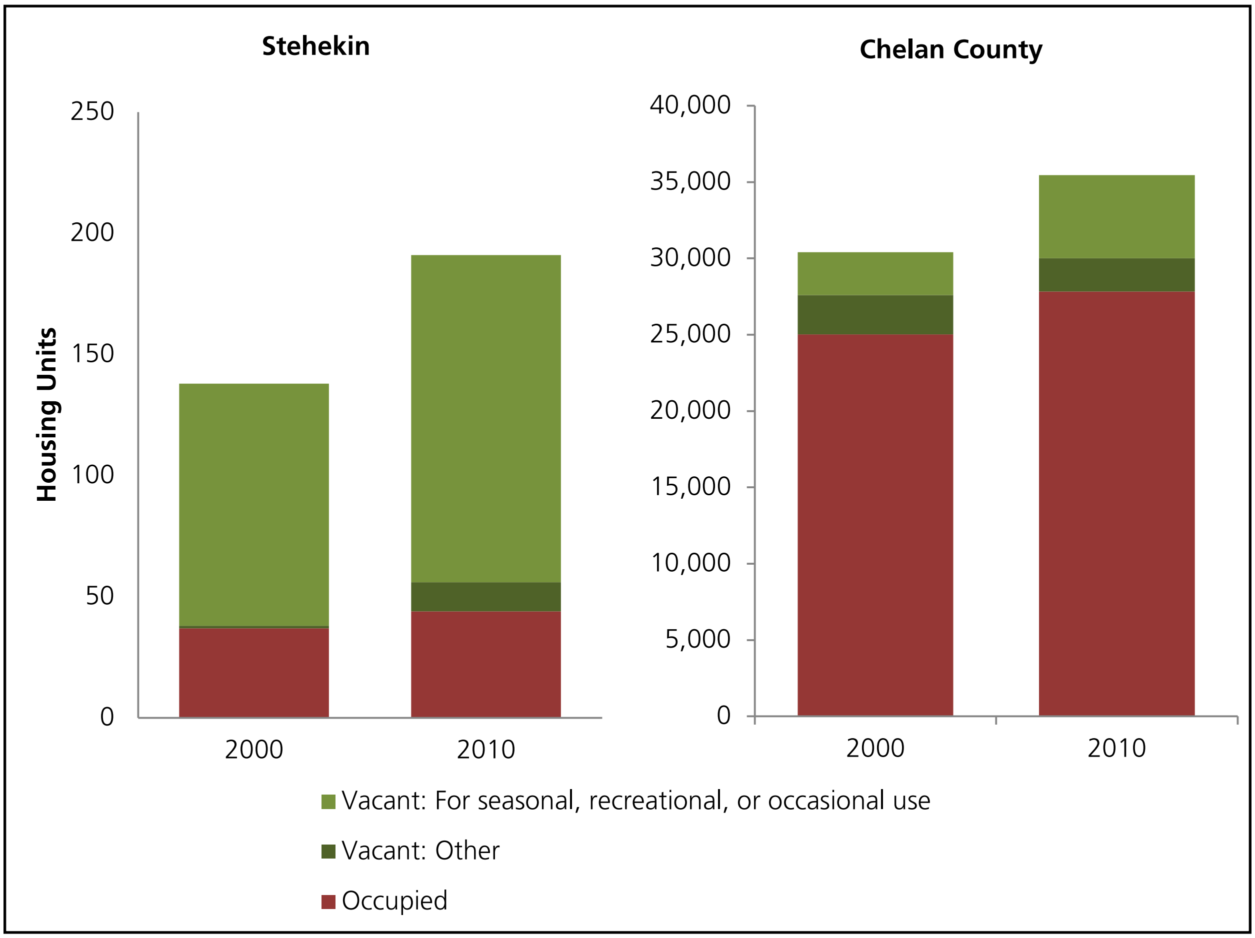
**Owner-Occupancy Rate:** is equal to the number of owner-occupied housing units divided by the total number of occupied housing units in the geographic area.

**Table III-19: Vacancy Rates in Stehekin and Chelan County (2000-2010)**

| Year | Vacancy Rate | | | Total Housing Units (#) |
|---|---|---|---|---|
| | Seasonal, Recreation, Occasional Use (%) | Other Vacancy (%) | Total Vacancy (%) | |
| Stehekin | | | | |
| 2000 | 72.5 | 0.7 | 73.2 | 138 |
| 2010 | 70.7 | 6.3 | 77.0 | 191 |
| Change 2000-2010 | -1.8 | 5.6 | 3.8 | 53 |
| Chelan County | | | | |
| 2000 | 9.3 | 8.5 | 17.7 | 30,407 |
| 2010 | 15.4 | 6.2 | 21.5 | 35,465 |
| Change 2000-2010 | 6.1 | -2.3 | 3.8 | 5,058 |

*Sources: U.S. Census Bureau 2000, 2010 (Table H5)*

**Figure III-15: Occupancy in Housing Units in Stehekin and Chelan County (2000-2010)**



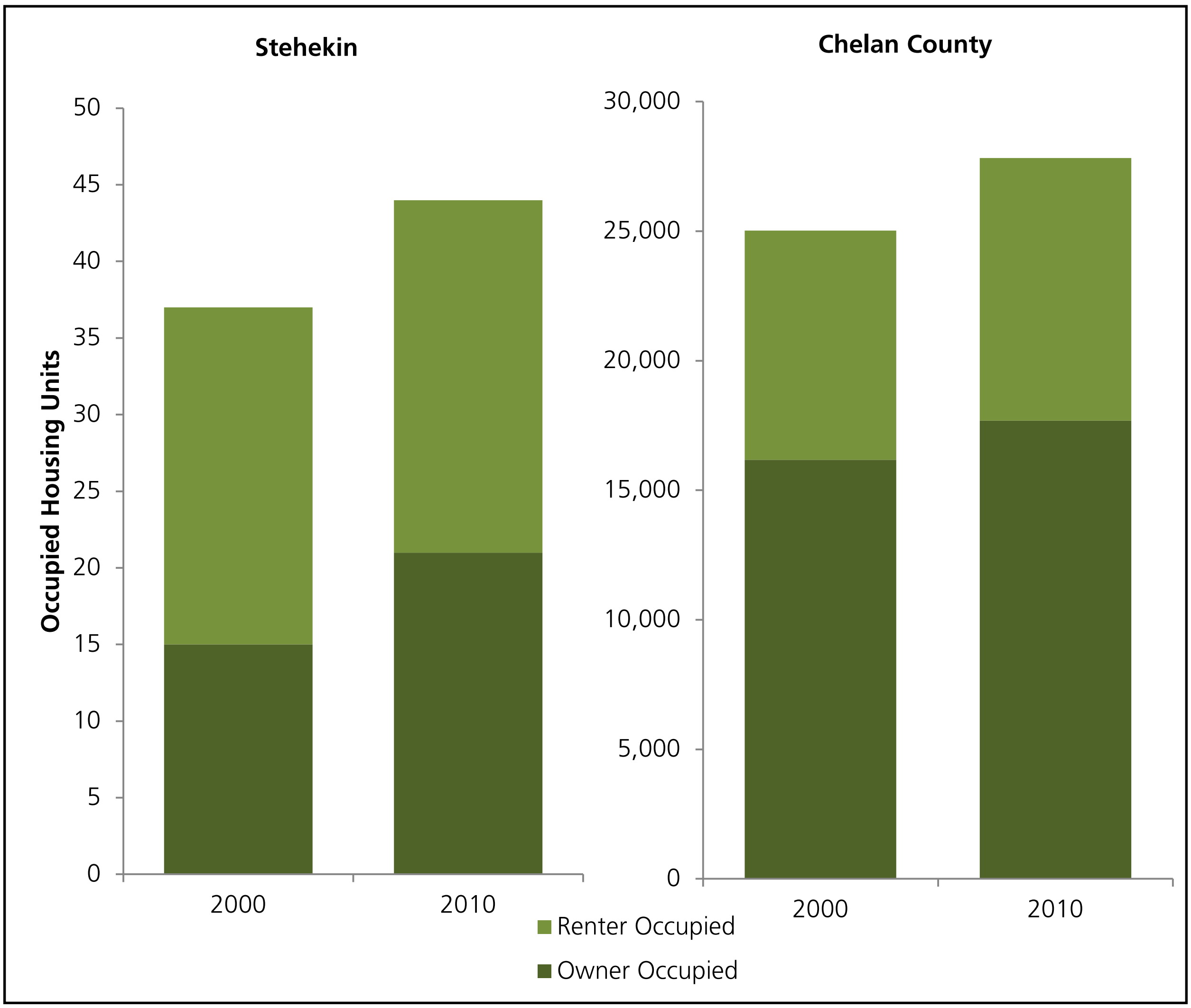

*Sources: U.S. Census Bureau 2000, 2010 (Table H5)* percent during that same time period (Figure III-16: *Ownership of Occupied Housing Units in Stehekin and Chelan County 2000-2010*) (U.S. Census Bureau 2000, 2010).

According to the forum Citydata.com, the estimated median house value in Stehekin in 2009 was approximately $220,590, which is lower than the state ($287,200). In comparison, the City of Chelan's median house value in 2009 was $356,181 (Citydata.com 2011).

### Employee Housing

As previously stated, the NPS now owns and operates approximately 23 housing units (20 buildings), including 14 houses, five apartments, two cabins, and two yurts. In summer 2011, these units housed 25 employees and volunteers for the NPS. Ten of these employees live in the Valley year-round. An additional 11 units (nine buildings) are used by an NPS concessioner, the Stehekin Landing Resort (Slinde pers. comm. 2012, Kurth pers. comm. 2011c).

**Figure III-16: Ownership of Occupied Housing Units in Stehekin and Chelan County (2000-2010)**




*Sources: U.S. Census Bureau 2000 (Table QT-H1) and 2010 (Table QT-H2)*

## Economic Characteristics

### *Employment*

#### Trends

"For slightly more than the first half of the twentieth century, the economy in Stehekin was strictly subsistence. In the 1940s, families with several children lived on a minimal amount of cash and relied heavily on game and garden produce for food" (Georgette and Harvey 1980:7).

The cash economy that did exist at the time was based on a few, seasonal industries: government work (trail work, maintenance, or firefighting for the U.S. Forest Service), visitor services (lodge employment and taxi service), resource extraction (lumber, mining, trapping), and horse packing. "There were also positions for a postmaster and a school teacher, and one family had a large apple orchard" (Georgette and Harvey 1980:7).

Some people in Stehekin who did not depend on local work for their cash income received support from outside sources in the form of disability payments or inheritance funds; others, unable to work, were cared for by their children or neighbors. Most people in Stehekin did not have dependable or secure sources of cash income, but relied instead on a combination of odd jobs frequently available, especially in summer" (Georgette and Harvey 1980:7-8).

While the types of businesses in Stehekin have not changed dramatically over the past century, the Valley's economic reliance on tourism has greatly increased, and the community has shifted from a subsistence to a cash-based economy. In addition to economic changes across the U.S. after WWII, the designation of Lake Chelan NRA marked the end of most resource extraction activities in the Stehekin Valley. These activities have been steadily replaced by tourism and visitor services over the past 60 years. As WWII came to a close and as men returned from overseas and gas-rationing ended, Americans began taking their first vacation in years, many traveling to remote places like Stehekin and other units of the National Park System. As a result, between the 1950s and 1960s, the tourism industry in Stehekin grew quickly, soon becoming the primary driver of the Stehekin economy (Robertson 1987:21; NPS 1987). By 1987, within 20 years of the creation of Lake Chelan NRA, the number of businesses in the Valley had nearly doubled (NPS 1987).

Today, the economy of Stehekin is still largely based on a seasonal tourism industry, with most private and public business based on providing visitor services. As a result, the Stehekin economy is reliant on a transient, seasonal population. Many of the jobs in the Valley are part-time, and some residents work several jobs.

#### Private Employment

While total employment figures for Stehekin are unavailable due to proprietary information, the NPS estimates that there are approximately 36 private for-profit and non-profit businesses that are currently based in and/or operate out of Stehekin (see Table III-20: *Stehekin Private Businesses (2011)*). Of these 36 businesses, just over half (19) operate year-round, with the rest on a seasonal schedule (March-November or shorter) (Kurth and Gempko pers. comm. 2011; Kurth pers. comm. 2011d).

**Table III-20: Stehekin Private Businesses (2011)**

| Business | Schedule | | Industry Type (see note below) |
|---|---|---|---|
| | Year-Round | Seasonal | |
| Alpine Services Company | | X | Arts, entertainment, and recreation |
| Arts and Humanities of Stehekin | X | | Arts, entertainment, and recreation |
| Barnhart photography | X | | Arts, entertainment, and recreation |
| Cascade Corrals (Stehekin Outfitters)*** | | X | Arts, entertainment, and recreation |
| Carpenters (5) | X | | Construction |
| Chelan Airways*** | | X | Transportation and warehousing |
| Cragg's Excavation** | X | | Construction |
| Discovery Bikes*** | | X | Arts, entertainment, and recreation |
| House that Jack Built* | | X | Retail Trade |
| JW Construction | X | | Construction |
| Kenmore Air*** | | X | Transportation and warehousing |
| Lady of the Lake | X | | Transportation and warehousing |
| Mark Courtney Construction | X | | Construction |
| North Cascades Institute | X | | Retail Trade |
| Rental Cabins | | | |
| Stehekin Mountain | | | |
| Cabin | | X | Accommodation and food services |
| Stehekin Log Cabins | X | | Accommodation and food services |
| Boulder Cabin | X | | Accommodation and food services |
| Cabin at the Lake | | X | Accommodation and food services |
| Flick Creek House | | X | Accommodation and food services |
| Stehekin Rainbow | | | |
| Falls Lodge | | X | Accommodation and food services |
| Rustic Retreat | X | | Accommodation and food services |
| Silver Bay Inn | X | | Accommodation and food services |
| Stehekin Adventure LLC*** | | X | Arts, entertainment, and recreation |
| Stehekin Fishing Adventures*** | | X | Arts, entertainment, and recreation |
| Stehekin Landing Resort* | X | | Accommodation and food services |
| Stehekin Maintenance & Machinery (Tom Courtney Tug and Barge)** | X | | Construction |
| Stehekin Outfitters*** | | X | Arts, entertainment, and recreation |
| Stehekin Pastry Company** | | X | Accommodation and food services |
| Stehekin Valley Ranch** | | X | Accommodation and food services |
| The Garden | | X | Farm employment |

| Business | Schedule | | Industry Type (see note below) |
|---|---|---|---|
| | Year-Round | Seasonal | |
| Weavtel | X | | Other services |
| Yeti Lumber | X | | Construction |
| * Concessioner with the NPS. | | | |
| ** Contracts regularly with the NPS. This list also includes the Stehekin Landing Resort, which is also a NPS concessioner. | | | |
| *** Operates business on NPS land under a Commercial Use Authorization with the NPS, 2011. | | | |
| Sources: Kurth pers. comm. 2011d; Lesmeister pers. comm. 2011e; Lesmeister pers. comm. 2011a | | | |
| Note: The industry types and categories are based on those used by the U.S. Bureau of Economic Analysis' Regional Economic Information System. The assigned industries are approximated by the NPS and are not reflective of the actual economic inputs or outputs of the business (which are unknown). | | | |

Considering Stehekin's tourism-based economy, most of these businesses are visitor service-oriented industries: approximately ten provide lodging; two primarily serve food (non-lodging); three provide transportation; six provide recreation services; two are retail-based; and two are involved in the arts. Many of these businesses also provide a variety of linked services (for example, larger lodging facilities may serve food and provide transportation for their guests) and/or are closely linked to other businesses that provide complementary services (such as recreation) (Kurth pers. comm. 2011d).

In addition to visitor services, ten businesses in Stehekin are related to construction (barge, welding, carpentry, etc.), and one business provides communication (phone) services to residents in the Valley (Kurth pers. comm. 2011d). See "Visitor Experience: Visitor Use Opportunities" for more information on the visitor services that these businesses provide in Lake Chelan NRA.

Of the approximately 36 private businesses that operate in Stehekin, two are concessions for the NPS: the House that Jack Built and the Stehekin Landing Resort (each marked with an asterisk in Table III-20). On October 31, 2011 the contract for the Stehekin Landing Resort expired under the former concessioner, Stehekin Adventure LLC. As required by law, a new contract was awarded through an open bidding process, but the former concessioner did not bid on the contract. Instead, Guest Services Incorporated (GSI) submitted the successful bid and was awarded a ten year contract with the NPS to begin on March 1, 2012 (Lesmeister pers. comm. 2011e).

Five other Stehekin businesses (each marked with two asterisks in Table III-20) receive regular contracts from the NPS for services such as trash hauling, road maintenance, and emergency response (for example: feeding fire fighters). Since 2006, the NPS has spent over $1.8 million (as of August 2011) on these five local contracts (which amounts to an average of approximately $329,000 per year (based on FY 2006 - 2010). Contracts for NPS operations account for 72.2 percent of this total, and contracts for incidents in Lake Chelan NRA account for 22.8 percent of the total (Kafka pers. comm. 2011) (Table III-21: *NPS Contracts with Stehekin Businesses (FY 2006-August, FY2011)*). In the past, the NPS has also purchased services and supplies from other Stehekin businesses, such as from several local carpenters (Welch pers. comm. 2011).

While many of the private businesses in Stehekin operate on private property (many are home-based), several operate on federal land under a Commercial Use Authorization (CUA) with North Cascades NPS Complex. The 2011 CUA permittees are designated with three asterisks in Table III-20 above. In 2011, these CUA permittees served approximately 2,900 visitors to Lake Chelan NRA (Lesmeister pers. comm. 2012). Five other businesses or special events have also obtained a CUA since 1993 but no longer operate with a CUA (Lesmeister pers. comm. 2011a).

**Table III-21: NPS Contracts with Stehekin Businesses (FY 2006-August, FY2011)**

| Fiscal Year | Operations | | Incidents | | Total |
|---|---|---|---|---|---|
| | $ | % of Total | $ | % of Total | |
| 2006 | $237,668 | 77.8% | $67,989 | 22.2% | $305,657 |
| 2007 | $294,147 | 53.6% | $254,710 | 46.4% | $548,857 |
| 2008 | $216,118 | 100.0% | | 0.0% | $204,108 |
| 2009 | $272,378 | 100.0% | | 0.0% | $264,656 |
| 2010 | $214,677 | 71.0% | $87,683 | 29.0% | $288,666 |
| 2011 obligation (as of 08/2011) | $142,663 | 100.0% | | 0.0% | $142,663 |
| Total | $1,390,967 | 76.6% | $410,382 | 22.8% | $1,754,607 |

*Source: Kafka pers. comm. 2011*

Compared to Stehekin, the Chelan County economy is primarily based on two seasonal industries: tourism (10 percent of jobs in the county are in accommodations and food services or arts, entertainment, and recreation) and agriculture (farming accounts for 11 percent of the jobs), which peak during the same general time each year (July through September) (NPS LACH 1995a:245; U.S. Bureau of Economic Analysis 2011a).

In addition to these seasonal economies, retail and health care and social assistance play a large role in Chelan County's economic base (accounting for another 11 and 12 percent respectively), with construction, manufacturing, whole sale trade, real estate, and professional services also providing substantial employment (each industry accounts for 4-6 percent of jobs in the county) (U.S. Bureau of Economic Analysis 2011a).

### Government Employment

In addition to private enterprises, four different governmental agencies operate within the Stehekin Valley, accounting for a large portion of the total employment in the community. While the NPS is the largest government employer in the Valley (and perhaps the largest employer including private businesses), at least ten other Stehekin residents work for other agencies in the federal, state, and county governments. The U.S. Postal Service (USPS) employs one year-round part-time postmaster (considered full-time by the USPS) and two part time assistants; the Chelan County Public Utility District employs one year-round operations attendant and two part-time assistants; and the Stehekin School District employs one full-time head teacher and at least five part-time positions (Kurth pers. comm. 2011b; Reinhart pers. comm. 2011; Scutt pers. comm. 2011b).

In 2011, North Cascades NPS Complex employed 36 people, including ten permanent staff, three term staff, nineteen seasonal (summer) staff, and four volunteers (paid with small stipend). Together these comprise employment for 18 Full-Time Equivalent (FTE) positions in Stehekin (Kurth pers. comm. 2011a). While government employment accounts for a large percentage of jobs in Stehekin, it accounts for a comparatively small (13 percent) share of jobs in Chelan County, most of which (69.8 percent) are with local governments. State employment accounts for 17 percent of government jobs in the county. Federal employment accounts for less than ten percent of government employment, or one percent of total jobs in the county (U.S. Bureau of Economic Analysis 2011a).

### Income

According to the U.S. Bureau of Economic Analysis, Chelan County's per capita personal income in 2009 was $35,237, up from $25,479 in 2000, but slightly down from 2008. In current dollars (not adjusted for inflation), Chelan County's per capita net earnings grew by about 5.2 percent annually between 1990 and 2009 which was slower than the state (5.6 percent) and faster than the nation (5.0 percent) (See Table III-22: *Per Capita Personal Income (1970-2009)*) (U.S. Bureau of Economic Analysis 2011b).

**Table III-22: Per Capita Personal Income (1970-2009)***

| | 1970 | 1980 | 1990 | 2000 | 2009 |
|---|---|---|---|---|---|
| Chelan County | $3,970 | $10,446 | $17,065 | $25,479 | $35,237 |
| Washington | $4,189 | $10,810 | $19,637 | $33,107 | $42,870 |
| United States | $4,084 | $10,091 | $19,354 | $30,318 | $39,635 |

*Source: U.S. Bureau of Economic Analysis 2011b*

**Dollars not adjusted for inflation.*
*Note: While the U.S. Bureau of Economic Analysis provides economic data for county, state, and metropolitan areas, this analysis could not find reliable data on income for Stehekin.*

## *Economic Benefits from Lake Chelan NRA*

Based on analysis for the 1995 GMP, the most recent Money Generation Model (2) (MGM2)[6] conducted by Michigan State University, the approximate 39,249 visitors (10,200 overnight stays) to Stehekin in 2010 spent an estimated $1.56 million on commercial transportation, lodging, food and drink, shopping, entertainment, automobile repair and services, private boats, and private aircraft in Stehekin and Chelan (NPS LACH 1995). While these visitor expenditures provide direct income in sales to the area, the MGM2 concludes that for every dollar spent by a visitor in direct sales, an additional $0.47 in sales is generated in the local region through secondary effects from income and job creation. Figures for Lake Chelan NRA in fiscal year 2010 indicate that non-local visitors to Lake Chelan NRA generated 20 jobs, $760,000 in income, and $1,272,000 in spending (Stynes 2011).[7]

6 *The money generation model study is based on recreation visits and overnight stays as reported by the NPS. Visitors are broken down into local day-trip visitors, nonlocal day-trip visitors, and visitors on overnight trips staying in motels or campgrounds inside or outside the recreation area based on previous visitor surveys. Visitor spending is estimated based on visitor-use survey data from selected parks where studies have occurred and is extrapolated to parks without studies. Spending does not include expenditures on durable goods that cannot be attributed to a single trip (Michigan State University 2008). Payroll information (wages and salaries plus benefits) was also obtained from the NPS. To account for different park settings, there are different multipliers for large urban, small urban, and rural areas. The multipliers are derived from IMPLAN, a federal land management agency standard used to evaluate economic impacts. IMPLAN was developed by the USFS to calculate economic impacts generated by national forests. A generalized list of these can be found in the GMP for the version of this software that was then available (1985) (NPS LACH 1995a:256 - 257). The multipliers are for the following activities: construction sand and gravel, industrial and commercial construction, maintenance and repair of facilities, local transportation services, water transportation, air transportation, hotels and lodging places, eating and drinking places, automobile repair and services, recreation-related retail trade, amusement and recreation services, and government-federal. The model does not include park operations expenses or construction activities, only base annual salaries. It also does not include the impacts of employees in regional offices or other administrative divisions, where visitation is not reported. As of summer 2011, Lake Chelan NRA has a payroll of 18 people in winter and approximately 32 in the summer, most of who reside in Stehekin. However, some work effort attributed to Lake Chelan NRA is part of North Cascades NPS Complex combined operations and is not directly related to either Stehekin or Chelan County. Based on concession contracts, additional staff is employed in visitor services for the concessioner. Money generated by the concession operation is reinvested to enhance visitor services for Lake Chelan NRA.*

7 *For the study, the impacts of job and income effects exclude spending by local visitors. According to the study, this is standard practice in economic impact analyses, because spending by local residents does not represent new money brought into gateway regions. Visitor spending is calculated for areas within 50 miles of the recreation area (Michigan State University 2008).*

In addition to visitor spending and NPS personnel costs, the NPS spends an average of $1.8 million every year in Lake Chelan NRA for ongoing NPS resource management, maintenance, and administration (including contracts to local businesses) (based on FY2006-2010 expenditures) (Kafka pers. comm. 2011). This figure, however, does not represent actual spending in the local economy because not all of these operational expenditures are made in Chelan County. Future impacts to the local economy from Lake Chelan NRA are dependent upon Congressional budgets and allocations to the NPS through the Department of the Interior.

## Community Assets

There are many community assets in the Stehekin Valley – both physical and service-based – that provide tangible resources to Stehekin residents, businesses, and visitors. These assets are briefly summarized below. Historical information is provided when available.

### *Physical Assets*

#### Natural Resources

(See also: Air Quality, Geology, Soils, Water Resources, Vegetation, Wildlife, and Special Status Species.)

As noted in previous sections, the Stehekin Valley is surrounded by an abundance of natural resources which have shaped the historic and current land use in Lake Chelan NRA.

Because of the geology and mineral deposits in and surrounding Lake Chelan NRA, Stehekin's economy was once largely based on a promising, but ultimately poor, mining industry.

Between the 1880s and 1940s, seasonal miners came to Stehekin with the hope of finding quartz, silver, or other valuable ores and metals, but, "compared to other mineral regions in the West, the North Cascades mines have produced but little wealth, barely enough to keep the dream of elusive riches alive" (Thompson 1970:89). By the end of World War I, mining had "all but ceased" in the Valley, and was officially brought to an end in 1968 with the creation of Lake Chelan NRA (Robertson 1987:19). Today, there is one remaining mining claim, Thunder Creek Mines, within North Cascades NPS Complex (Zipp pers. comm. 2011).

Lake Chelan NRA is a desirable destination for hunting and fishing, allowed on federal land under the enabling legislation. Under the jurisdiction of the Washington State Department of Fish and Wildlife (WDFW), local residents and visitors with hunting licenses can hunt for black bear, deer (the high hunt is particularly popular in Stehekin), elk, bobcat, cougar, fox, raccoon, cottontail rabbit, snowshoe hare, grouse, and coyote during state designated hunting seasons (WDFW 2011a). Those with fishing licenses can also fish during the state designated fishing seasons (WDFW 2011b). Although the NPS is uncertain of how much actual use occurs at the shooting range, some residents (some of whom live a subsistence lifestyle) also use the NPS-owned shooting range for shooting practice, siting, and safety checks for weapons. WDFW certified instructors have also used the shooting range for "Hunter Education Field Skills Evaluation"(see Chapter III: Park Operations "Shooting Range").

#### Access and Transportation

(See also: Park Operations, Roads, and Bridges.)

### *Transportation to and from Stehekin*

As noted in the introduction to this section, there are only three ways to access Stehekin from other regions in Washington.

**Boat/Ferry:** Residents and visitors can boat into Stehekin by ferry or on their personal boat from Chelan.

Since 1889, the current ferry system has been operated by the Lady of the Lake Boat Company, a private boat company that operates under the jurisdiction of the Washington State Utility and Transportation Commission (WUTC). Under their agreement with the WUTC, the Lady of the Lake pays an annual fee (based on revenues), submits annual data to the WUTC, and must seek permission from the WUTC to make any changes to the rates or schedule (Engstrom, personal communication, 2011).

As a private company that provides regulated public transportation, the Lady of the Lake offers twice daily service to the Valley during the summer/high season and reduced service (Monday, Wednesday, and Friday) during the winter (Engstrom pers. comm. 2011). There are two passenger vessels in the Lady of the Lake fleet, neither of which has the capacity to handle vehicles: the Lady II, $40 round trip, travels to Stehekin in four hours from Chelan, and the Lady Express, $60 round trip, travels that same distance in two and a half hours (ladyofthelake.com). Residents and visitors can also drive part-way up the lake and take the ferry from Fields Point Landing (parking lot located part-way up Lake Chelan along the western shore of the Lake) (parking is $7.00 per day) to reduce the length of the trip (holdenvillage.com). Both ferries make only one round-trip each day when in service.

As well as transporting passengers, the Lady of the Lake serves as an important delivery vehicle for community needs. In addition to residents' use of the ferry system to transport grocery orders and other goods and services from Chelan,[8] the company also operates under a contract with the USPS to deliver all mail between the Chelan and Stehekin Post Offices for an annual fee of $81,560.24 (as of December 31, 2011) (Ledbetter pers. comm. 2012). This contract, in place for well over 30 years (likely also dates to 1892 when the first Stehekin Post Office was established), specifies which days the ferry will deliver mail to Stehekin and is likely what initially determined the ferry's winter operations schedule. While this contract does not fund the full cost of the round-trips to Stehekin, winter runs would likely be less feasible, and would occur less frequently, without this contract (Engstrom pers. comm. 2011).

Currently the Lady of Lake is the only state permitted ferry system on Lake Chelan. Two Stehekin residents filed suit against the Washington State Transportation Commission in October 2011, however, to obtain a permit to operate an alternative service on the lake (Dininny 2011).

For large items that need to be transported to Stehekin, one Stehekin business operates a barge on Lake Chelan. Residents use the barge to transport vehicles and construction materials into the community, and the NPS often contracts with the private business to transport construction materials, vehicles, and other needed items. Between fiscal year (FY) 2006 and FY2010, the NPS paid $242,955 to barge materials between Stehekin and Chelan, averaging about $48,600 every year (not including costs for hauling compacted waste) (Kafka pers. comm. 2011).

8 *At least one grocery store in Chelan takes phone/e-mail orders from Stehekin residents, boxes up the order, and ships it to the community via the Lady of the Lake.*

Boating facilities at the Stehekin Landing include 9,435 square feet of docks (publicly owned), a fueling station (operated by an NPS contractor for an average of $11,118 annually based on FY2006-2010) and an ADA and ABA (Architectural Barriers Act of 1968) accessible dock for the Lady of the Lake that the NPS renovated in 2011 (Kafka pers. comm. 2011).

**Air:** The quickest but most expensive transportation method to Stehekin is air transport: either by personal aircraft or through Kenmore Air or Chelan Airways. Chelan Airways provides daily service between Chelan and Stehekin between June and October every year with limited service in May (www.chelanairways.com). The current cost of a round trip ticket for this 25 minute flight is $170.00 per person (Chelan Airways pers. comm. 2011). The company also offers charters and air tours of Lake Chelan, Stehekin, and North Cascades NPS Complex.

Air transport can be via seaplane or a lightweight wheeled aircraft. Seaplanes land on the northern tip of Lake Chelan and dock at the Stehekin Landing. Wheeled aircraft can land at the Stehekin airstrip, a 2,630 foot grass airstrip maintained by the State of Washington through a Special Use Permit with the NPS. This airstrip, considered by the Washington State Department of Transportation, Aviation Division, to be "one of the most difficult airports in the state", is usually open for a limited season: from June 1 to October 1 every year (WSDOT 2011).

**Trail Network:** Residents and visitors can also hike into the community from the North Cascades Highway, Mount Baker Snoqualmie National Forest, or Wenatchee National Forest (all trail access eventually goes through Lake Chelan NRA). Lake Chelan NRA has approximately 128 miles of trails and 14 camping areas that are maintained by the NPS, most of which are accessible to stock. The shortest trip into the Valley (from the nearest road) by foot or stock is 18 miles along the Bridge Creek Trail (part of the Pacific Crest Trail).

Based on these transportation options, the per person cost to travel to Stehekin can vary between free (if hiking) and $170.00 per person, though most residents and visitors to the Valley pay $40-60 for the round trip ticket with the Lady of the Lake, with an additional $7.00 per night to park in Chelan or at Fields Point Landing. Table III-23: *Cost Scenarios for a Two Night Stay in Stehekin for Family of Two (Summer 2011)* outlines three expense scenarios for a family of two who take a two day vacation to Stehekin during the summer.

### *Transportation within Stehekin*

Once in Stehekin, transportation is primarily along two major roads: the Stehekin Valley Road and Company Creek Road, both of which are maintained by the NPS (which also employs local contractors for some of the work) at an expense of approximately $200,000 every year (based on average expenditures between FY2003 and FY2007). Between 2003 and 2007, the NPS spent over $1 million on road maintenance, snow removal, and road repairs from storm damage in the Stehekin Valley, 45.7 percent of which was awarded to a local contractor (Table III-24: *Stehekin Road Maintenance Costs (2003-2007)*) (Slinde pers. comm. 2011; Cowen pers. comm. 2011b).

The two roads, totaling approximately 14.2 miles in length, are maintained by the NPS to provide visitor and NPS administrative access to Lake Chelan NRA and North Cascades National Park. By maintaining these roads, the NPS also facilitates the community's ability to commute to work, conduct business, access services, and socialize. These roads provide critical infrastructure for businesses and the government in daily operations, and they provide access for visitors to scenic, recreational, and commercial amenities in the Valley.

**Table III-23: Cost Scenarios for a Two Night Stay in Stehekin for Family of Two (Summer 2011)**

| | Low Cost | Moderate Cost | High Cost* |
|---|---|---|---|
| Parking | $21.00 | $21.00 | $21.00 |
| Transportation | $78.00 | $118.00 | $340.00 |
| Shuttle | $20.00 | $40.00 | $0.00 |
| Camping / Lodging | $0.00 | $200.00 | $590.00 |
| TOTAL | $119.00 | $379.00 | $951.00 |

*Low Cost: This scenario includes parking for three days in Chelan, taking the Lady of the Lake III, shuttling upvalley one time during visit, and camping overnight at a NPS campground.*

*Moderate Cost: This scenario includes parking for three days in Chelan, taking the Lady Express, shuttling upvalley twice during the visit, and staying overnight in the least expensive lodging in the valley.*

*High Cost: This scenario includes parking for three days in Chelan, flying to Stehekin with Chelan Seaplanes, and staying overnight at the most expensive lodging in the Valley. Most of the higher-end lodging includes free shuttle rides or a personal vehicle.*

**May include meals.*

*Sources: www.rainbowfallslodge.com/cabin.html; www.chelanseaplanes.com/; www.stehekinlanding.com/; http://stehekin.com/; www.stehekinchoice.com/valley/lodging/cabin_at_the_lake/cabin_on_the_lake_homepage.htm; http://stehekinvalley.com/flick-creek-house/; www.ladyofthelake.com/; www.silverbayinn.com/ratesamenities.htm; http://stehekinvalleyranch.com/; www.stehekinchoice.com/valley/lodging/stehekin_cedar_home.htm; http://stehekinvalley.com/mountain-cabin/; stehekinpastry.com/stehekin-log-cabins_295.html; www.rainbowfallslodge.com/cabin.html.*

**Table III-24: Stehekin Road Maintenance Costs (2003-2007)**

| Year | Regular Road Maintenance (includes snow removal, patching, brushing, and labor costs) | | Storm Damage Repair Work | | Total: Contract | | TOTAL NPS EXPENDI-TURES |
|---|---|---|---|---|---|---|---|
| | Stehekin Contracts | NPS | Stehekin Contracts | NPS/ Materials | Total $ | Total % | |
| 2003 | $34,400 | $98,200 | | | $34,400 | 25.90% | $132,600 |
| 2004 | $34,000 | $71,000 | $125,342 | $43,181 | $159,342 | 58.30% | $273,523 |
| 2005 | $20,000 | $107,000 | $103,455 | $53,648 | $123,455 | 43.50% | $284,103 |
| 2006 | $27,400 | $101,000 | ** | ** | $27,400 | 21.30% | $128,400 |
| 2007 | $33,373 | $47,289 | $88,395 | $33,034 | $121,768 | 60.30% | $202,091 |
| TOTAL | $149,173 | $424,489 | $317,192 | $129,863 | $466,365 | 45 .7% | $1,020,717 |

*** A major flood occurred in October 2006 that damaged large sections of road. While the NPS began planning for repairs in 2006, storm damage repair work began the next year, in 2007, and continued through to 2009.*

*Sources: Slinde pers. comm. 2011; Cowen pers. comm. 2011b*

There are also two parking areas on federal land at the Stehekin Landing that are open to all residents and businesses free of charge for loading/unloading materials and long-term parking. Often one of the busiest areas in the Valley, these two lots, totaling 8,384 square feet in size, are often congested with vehicles, particularly during arrivals/departures of the Lady of the Lake (Cowen pers. comm. 2011a). (In comparison, parking in Chelan or at Fields Point costs $7.00 per night, $75.00 per month, $90.00 for three months or $210.00 per year.) While most Stehekin households own a vehicle for personal transportation, visitors to Stehekin can access amenities upvalley via a shuttle service that has operated since the early 1900s. While the service has varied over time with regards to the provider (private and/or public service), means of transport (horse, taxi, bus, shuttle), and destination (Stehekin Bakery, Rainbow Falls, High Bridge, Cottonwood, etc.), the shuttle service today is operated by an NPS concessioner along the first 11 miles of the Stehekin Valley Road (Lesmeister pers. comm. 2011d). During the 2011 summer season, this shuttle ran from the Stehekin Landing to High Bridge Ranger Station with a fare of $5.00 for adults and $2.50 for children (one-way). During the high season from June to October, the shuttle runs four times a day. In the early and late season (mid-May to June, and early to mid-October), runs are reduced to weekends (early season) or twice a day (late season) (http://stehekin.com).

## Communication Infrastructure

Physically remote, Stehekin can be technologically remote as well. Most Stehekin residents access internet services through personal satellite dishes, and some have Voice over Internet Protocol phone service (e.g. SKYPE or another system). Phone service in the Valley is limited. The NPS maintains a satellite phone system for administrative use at the district offices in the Golden West Visitor Center and provides a public pay phone near Stehekin Landing.

In addition, a private phone company, Weavtel, has set up a system to provide phone service to residents within the first 1.5 miles of the Landing. Some residents subscribe to this service.

## Utilities

### *Electricity*

"Most [Stehekin] residents did not have electric power [prior to the designation of the Lake Chelan NRA], and the few that did had their own small hydroelectric systems or gasoline generators" (Georgette and Harvey 1980:9). The largest of these private systems was a 1940 hydroelectric system on Company Creek (generating capacity of 65 kw) that had been built by a local resident. In 1963, after the urging of Valley residents, the Chelan County Public Utility District No. 1 (PUD) leased and renovated this plant and supplemented its power with a WWII-surplus diesel generator. With the increase in access to electricity (as well as the community's transition to a cash economy), many Stehekin residents began purchasing electricity from the PUD and in turn began purchasing more modern electrical equipment and appliances as well. As a result, demand increased so much so that by 1967, the PUD "began exploring ways to meet the projected load" (Georgette and Harvey 1980:10).

In 1968, the PUD built an "enlarged hydroelectric system in Stehekin Valley on Company Creek" that was able to generate 200kw of energy and included two diesel generators as backups (capable of supplying 75kw) (Georgette and Harvey 1980:10). By the end of that year, the PUD was serving 74 customers (meters) (Georgette and Harvey 1980).

Today, the Chelan County PUD, through the operation of this hydroelectric plant, provides electricity to most private residences and commercial establishments in Stehekin. As of fall 2011, Chelan County PUD provides service to 131 residential and 22 commercial customers (meters). Eighteen of these meters are owned and operated by the NPS (Tupling pers. comm. 2011).

As with the rest of Chelan County, Stehekin electricity costs are subsidized by Chelan County PUD whole sale operations (surplus power sales on the open market). "Costs per kilowatt-hour produced at Stehekin are higher than for the rest of the county, given the small hydro plant, the diesel backup and the harsh environment for distribution lines" (Tupling pers. comm. 2011). These increased costs are reflected in higher electricity rates in Stehekin. While Chelan County customers pay 2.29 cents per meter for the first 1000 kilowatt hours of use, customers in Stehekin pay 4.07 cents per kilowatt hour for the first 400 kilowatts and up to 11.29 cents per kilowatt hour for use of more than 751 kilowatts (Chelan PUD, Electric Rates Schedule).

To operate the plant, read meters, and troubleshoot problems, the PUD currently employs three employees in Stehekin that staff the facility for four hours every day. The Stehekin Operations Attendant works 28 hours per week, and the other two assistants fill in when necessary (Reinhart pers. comm. 2011). The plant operates under a special use permit from the NPS to maintain its power lines.

In addition to the electricity it supplies to Stehekin, Chelan County PUD owns and operates a hydroelectric dam on Lake Chelan that was constructed in 1927 to supply electricity to the regional grid. This project (The Lake Chelan Hydro Project) effectively raised Lake Chelan 21 feet, submerging some of the land at the head of the lake (Chelan PUD, chelanpud.org). In the 1960s, before the NRA was established, some private property owners filled in a part of the reservoir drawdown and constructed houses over the fill, some of which are rental units.

Photo 26 – The Stehekin Landing (John Chao).

### *Heat*

Most Stehekin residents use firewood as their primary source of heat during the winter months. Other than gathering firewood on private property, Stehekin residents and businesses, under the guidelines of the NPS 1995 Firewood Management Plan, may annually purchase a firewood permit from the NPS that allows them to collect up to six cords of firewood each year at a cost of $15.00 a cord (NPS 1995). Between 2005 and September 1 of 2011, the NPS provided 516 cords of wood to residents and/or businesses in the Valley. Stehekin residents and businesses annually apply for permits for an average of 74 cords of wood with a range from 44 to 98 cords a year. With average consumption of 3.7 cords per permittee, per year, Stehekin residents pay, on average, $55.50 to heat their home or business every year from NPS firewood permits (not including the cost of cutting and stacking the wood) (See Table III-25: *Stehekin Firewood Permits Issued (2005-September 1, 2011)*) (Gempko pers. comm. 2011). An unknown number of residents also use propane to heat their home and/or business. Propane is delivered by barge and truck by a local business.

**Table III-25: Stehekin Firewood Permits Issued (2005- September 1, 2011)**

| Year | Cords | Permittees | | |
|---|---|---|---|---|
| | | Total | Year-Round Res. | Seasonal Res. |
| 2005 | 44 | 11 | 9 | 2 |
| 2006 | 98 | 21 | 17 | 4 |
| 2007 | 60 | 14 | 10 | 4 |
| 2008 | 90 | 28 | 21 | 7 |
| 2009 | 69 | 21 | 16 | 5 |
| 2010 | 73 | 23 | 20 | 3 |
| 2011 | 82 | 24 | 17 | 7 |
| TOTAL | 516 | 142 | | |

*Source: Gempko pers. comm. 2011*

The Firewood Management Plan established the current approach for the NPS distribution and sale of firewood to Stehekin residents (NPS LACH 1995g). In 2005, the *Forest Fuel Reduction Plan* was also approved (NPS LACH 2005e). Implementation of this plan has focused on reducing the wildland fire fuel load from targeted areas in the Valley to reduce the threat of catastrophic fire to the valley floor. Part of this effort has included hiring a local contractor to conduct forest thinning operations for large diameter trees. Logs from this thinning work are hauled to a woodlot between the NPS maintenance facility and airstrip, where community residents with a firewood permit can collect wood (NPS LACH 1995g). Between fiscal years 2006 and 2010, the NPS paid $99,900 to a local contractor for thinning services. As of fall 2011, the NPS had completed much of the larger scale forest fuels reduction contracts within the original Forest Fuel Reduction Areas. The NPS is currently reviewing the status of the Forest Fuel Reduction Program and the Firewood Management Program (Oelfke pers. comm. 2011).

### *Water*

While most residents are dependent on wells for private residential and business water consumption, the NPS operates nine water systems in Stehekin (including two public systems as defined by Washington State) that supply water to NPS facilities (including housing), NPS concessions, and two private residences (which are charged for usage) (Torkelson pers. comm. 2011).

### *Sewer and Septic*

The NPS also operates a wastewater and sewer treatment plant at the Stehekin Landing which is used by the concession-operated lodge, private housing, and NPS residences and offices at the Stehekin Landing. The NPS also has 15 septic systems in the Valley that serve NPS and concession housing and administrative facilities. Data for the number of private septic systems in Stehekin is not readily available; however, it is likely that there are septic systems for each residence or collection of residences on a single property.

### *Waste Disposal*

The NPS operates a solid waste transfer facility and handles all of the solid waste, currently free of charge, for the Stehekin Community. Operating this facility is in violation of 36 CFR Part 6, which says that the NPS should not handle solid waste from private or commercial sources. As a result, the NPS is also unable to charge fees for waste collection/disposal. Washington State regulations place the responsibility for solid waste collection and handling with the counties. North Cascades NPS Complex and Chelan County are currently undergoing negotiations to bring the solid waste handling into compliance with state and federal regulations.

In 2010, the NPS compacted 428 cubic yards of garbage, disposed of another 311 cubic yards of loose garbage, recycled 95 cubic yards of materials, and hauled 150 cubic yards of construction and demolition debris out of the Valley that were generated by the NPS, Stehekin businesses and residents. Because there is no landfill in the Valley, the NPS pays to have the material shipped (barged down Lake Chelan) via a local contractor. In 2010 the NPS spent $106,000 on handling, shipping and disposal of solid waste generated in Stehekin, $57,000 of which went to a local contractor (See Table III-26: *Waste Disposal Activities in Stehekin (FY2010)*) (North Cascades NPS Complex 2012).

**Table III-26: Waste Disposal Activities in Stehekin (FY2010)**

| Item | Cost (approximate) |
| --- | --- |
| Contract with Stehekin Business (hauling, barging, and disposal) | $57,000 |
| NPS costs (labor, supplies, equipment, utilities, and disposal)) | $49,000 |
| TOTAL | $106,000 |
| *Source: Welch pers. comm. 2012* | |

## Land Use and Ownership

### *Public Land*

Stehekin is located within over six million acres of public land which has been subdivided into separate units under the jurisdiction of the federal government. Close to 1.5 million acres of land to Stehekin's east and west are under the jurisdiction of the U.S. Forest Service in the Okanogan Wenatchee National Forest. The Stehekin Valley is located within the heart of Lake Chelan NRA, a 61,951 acre unit managed by the NPS. Two other NPS units extend north of Lake Chelan NRA to the Canadian border: North Cascades National Park (504,780 acres) and Ross Lake National

Recreation Area (116,789 acres), all three of which are managed collectively as North Cascades NPS Complex. Approximately 94 percent of this area is also designated wilderness known as the Stephen Mather Wilderness (642,332 acres immediately adjacent to Stehekin). The Lake Chelan Sawtooth Wilderness (151,680 acres east of Stehekin), and the Glacier Peak Wilderness (572,000 acres west of Stehekin) both managed by the USFS are also within several miles of the Stehekin Valley. Lake Chelan NRA also contains 59,337 acres that are owned by the federal government and 2,197 of which are owned by the state and county (including 3.2 acres owned by the Stehekin School District). (See also: Land Use.)

*Private/Public Ownership*

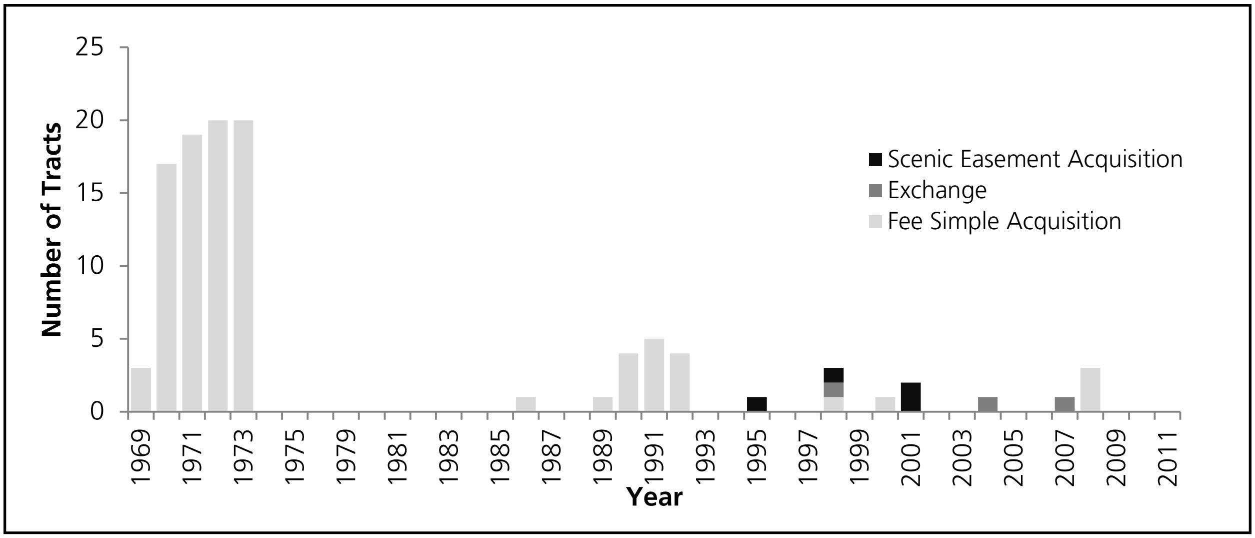
Lake Chelan NRA was designated by Congress in 1968 with 58,133.90 acres that had previously been managed by the USFS. Since that time, Congress has appropriated funding for the continued acquisition and exchange of land within the Stehekin Valley. Within the first five years of the establishment of Lake Chelan NRA, 57 unique private landowners sold just over 980 acres in 79 tracts to the NPS. Since that time (1973), the NPS has participated in 20 fee simple[9] land acquisitions, four scenic easement acquisitions, and three land exchanges with private landowners. In one of these exchanges, the NPS acquired the fee simple rights to a property in Lake Chelan NRA and in exchange, the landowners received a property from Olympic National Park. In one of the other exchanges, the NPS acquired the fee simple rights to a tract within North Cascades National Park and in exchange, the landowner received a property within Lake Chelan NRA. In addition to exchanges, the NPS transferred a 3.2 acre parcel to the Stehekin School District in 1987 while maintaining scenic easements on the property (Holyoke pers. comm. 2011). As shown in Figure III-17: *NPS Land Acquisition and Exchanges in Lake Chelan NRA (1969-2011)*, the majority of NPS fee acquisition was completed almost 40 years ago. Since 1968, the NPS has paid approximately $5.6 million (not adjusted for inflation) to Stehekin private property owners to purchase property or easements.

Since 1995, when the last LPP was approved the NPS has participated in five fee simple acquisitions, four easement purchases, and three land exchanges in Lake Chelan NRA (Holyoke pers. comm. 2011) (Table III-27: *NPS Land Acquisitions and Exchanges: 1968-1994 and 1995-2011*). These more recent NPS land transactions have accounted for less than nine percent of all land transactions in the Stehekin Valley since that time (as of February 2012) (Cornelius pers. comm. 2012).

According to Chelan County Assessor files, there were approximately 81 land transactions[10] in the Stehekin Valley/Lake Chelan NRA between June 25, 1992 and February 16, 2012, with an average of four land transactions every year (not including 2012). Of these transactions, less than nine percent (seven) involved land acquisition by the federal government (one of which was an acquisition of a parcel in North Cascades National Park), and more than 91 percent of transactions resulted in a sale to a private landowner. Based on this data, of the approximately 84 private parcels in the Stehekin Valley,[11] roughly 35 percent were sold at least once during this time period to another private landowner (Figure III-18: *Land Transactions in the Stehekin Valley (June 25, 1992 - February 16, 2012)*) (Cornelius pers. comm. 2012).

9 *A fee simple land acquisition means that all rights associated with that tract are transferred to a different owner.*
10 *A Land Transaction could include the sale of one or more parcels to a private or public buyer.*
11 *NPS tracts include one or more parcels that have been delineated by Chelan County. The total number of parcels listed here includes all Chelan county identified parcels that align with NPS tract numbers (located in the Stehekin Tax District and Lake Chelan NRA), with an additional three parcels that a) are listed on the Chelan County Assessor's sales data, and b) are located in the Stehekin Valley as determined by using the Chelan County GIS program (http://63.135.55.50/ChelanCounty/default.aspx). These parcels are not currently reflected in NPS files.*

**Figure III-17: NPS Land Acquisition and Exchanges in Lake Chelan NRA (1969-2011)**



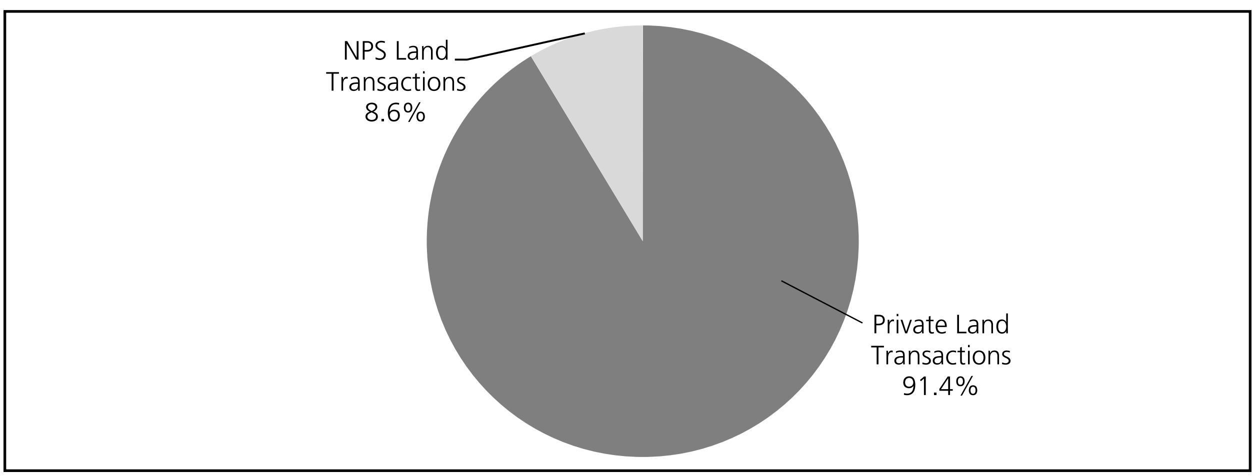

*Source: Holyoke pers. comm. 2011*

**Table III-27: NPS Land Acquisitions and Exchanges: 1968-1994 and 1995-2011**

| | Fee Simple Acquisition | | Acquisition of Easement | | Land Exchange | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Tracts | Acres | Tracts | Acres | Tracts | Acres | Tracts | Acres |
| 1968-1994 | 94.0 | 1,173.3 | - | - | - | - | 94.0 | 1,173.3 |
| 1995-2011 | 5.0 | 29.1 | 4.0 | 8.6 | 3.0 | (7.1) | 12.0 | 30.7 |
| TOTAL | 99.0 | 1,202.5 | 4.0 | 8.6 | 3.0 | (7.1) | 106.0 | 1,204.0 |
| 1995-2011 % of Total | 5.1% | 2.4% | 100% | 100% | 100% | 100% | 11.3% | 2.5% |

*Source: Holyoke pers. comm. 2011*

**Figure III-18 Land Transactions in the Stehekin Valley (June 25, 1992-February 16, 2012)**




*Source: Cornelius pers. comm. 2012*

### Private Land

According to NPS files, there are 416.80 privately owned acres (168 tracts) in the Stehekin Valley.[12]

As of 2011, these private tracts were owned by approximately 131 individual private landowners, each holding, on average, 3.18 acres of land[13] and 1.28 tracts. Of the known property tax mailing addresses of these landowners, about 25 (20 percent) have Stehekin mailing addresses, while the remaining 98 (80 percent) have property tax mailing addresses outside of the Stehekin Valley.[14] This means that approximately 73 percent of the total private acreage in the Valley is owned by individuals whose primary tax address is outside Stehekin. Since there are a total of 168 tracts in the Valley and 131 landowners, 26 landowners own more than one tract, with one landowner owning five tracts. The largest acreage owned by any one landowner is 30.7 acres, and the smallest is 0.1 acres (Table III-28: *Distribution of Total Private Acreage in Stehekin (2011)*). These figures include both fee simple properties and properties with easements. When landowners are ranked by the number of acres owned, the top 25 percent of landowners (in number of acres owned) own approximately 83 percent of the total private acreage in the Valley (Table III-28).

### Development

For the health, safety, and welfare of Stehekin Valley residents, all private development in Stehekin falls under the jurisdiction of Chelan County's zoning code. Under the county's Comprehensive Plan (2000), most of the public land in Stehekin is zoned Forest/Commercial (FC) and most private land is zoned as Rural Residential (RR), varying in lot size from 2.5 acres (RR2.5) to 20 acres (RR20) (Figure III-19: *Chelan County Zoning Code, Lower Stehekin Valley (2011)*).

Within these RR zones, lots are limited to one dwelling per associated acreage (e.g. one dwelling per 2.5 acres in RR2.5) with a maximum height of 35 feet. While residential uses are the primary allowable uses in these zones, land owners can have a variety of other uses on the land including: isolated cottage industries, non-residential uses, and small scale businesses (allowed in every zone except for RR20); recreation or tourism uses; and other uses associated with agricultural or service industries. These lots, except for RR20, can also be a part of planned unit developments and cluster developments, allowing for higher densities (Chelan County 2011: Title 11).

While agricultural, tourism, and recreation uses are all generally permitted in RR zones, industrial and business uses require a Conditional Use Permit (CUP) from Chelan County. Historically, through this case-by-case permitting process, Stehekin landowners have been able to obtain a CUP for uses such as mechanical shops for fabrication and equipment repair, cabinetry, and portable saw mills. These uses are evident in the number of businesses that operated on private property in the Valley (Chelan County 2011: Title 11).

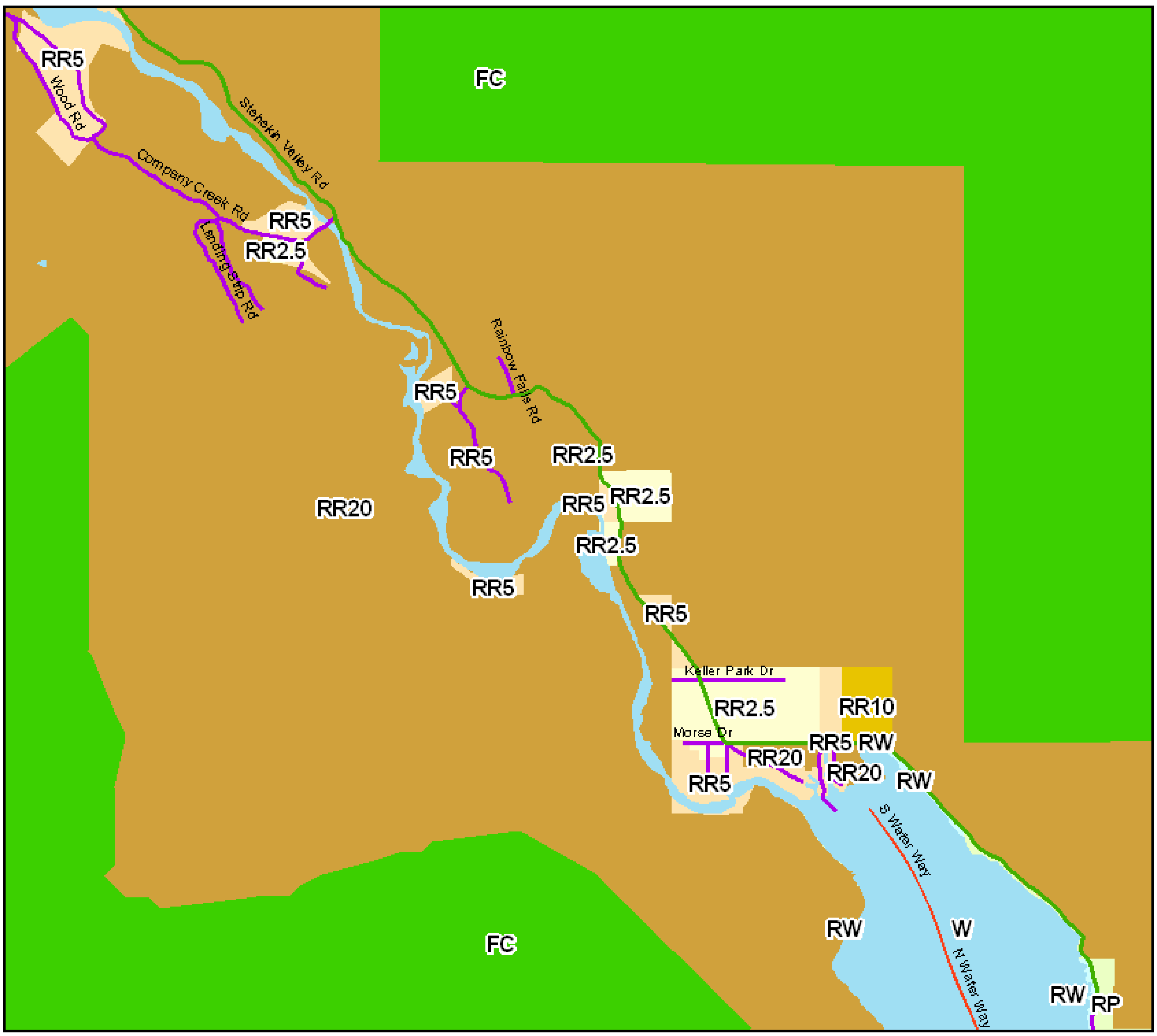
Only two other zones exist within the Valley: a rural waterfront zone (RW) is located along Lake Chelan and a rural public lands and facilities zone (RP) is located at the Stehekin Landing and includes all concession operations and the Golden West Visitor Center (Chelan County 2011:Title 11).

*12 According to the 2000 Chelan County Comprehensive Plan, 820 acres in Stehekin are privately owned. This discrepancy is likely due to the defined area of scope (Chelan County 2009).*
*13 This average is comparable to the average parcel size in 1985 (NPS 1985).*
*14 To calculate these figures, NPS landowner records were aligned with mailing addresses listed in the Chelan County Assessor's parcel data. "Local residents" are those who receive their property tax bill at a Stehekin address, while "non-Stehekin residents" receive their tax bill at another address outside the valley. The NPS was unable to determine addresses for eight landowners.*

**Table III-28: Distribution of Total Private Acreage in Stehekin (2011)**

| Number of Acres Owned by Individual Landowner | Number of Landowners | Percentage of Acreage |
|---|---|---|
| 30+ Acres | 1 | 7.4% |
| 20-29.99 Acres | 4 | 24.8% |
| 10-19.99 Acres | 5 | 16.0% |
| 5-9.99 Acres | 10 | 17.2% |
| 1-4.99 Acres | 41 | 26.1% |
| < 1 Acre | 70 | 8.5% |
| TOTAL | 131 | 100 % |

**Figure III-19: Chelan County Zoning Code, Lower Stehekin Valley (2011)**




*Source: Chelan County, Chelan County GIS.*

### *Land Value and Property Tax*

As of 2011, the total assessed value of non-exempt properties in the Stehekin Tax District was \$20,416,258[15] (Table III-29: *Calculation of 2011 Property Tax Payment for Stehekin* shows how this figure was calculated based on the 2011 tax base and levy rate) (Walter pers. comm. 2011a). Based on this assessed value and current property tax levies,[16] Stehekin landowners, along with those in the rest of the tax district, paid a total of \$130,509 in property taxes to Washington State in 2011.

**Table III-29: Calculation of 2011 Property Tax Payment for Stehekin**

| Tax base in Stehekin | x | 2011 Levy Rate (\$/1000 assessed value) | = | Property Tax Payment |
|---|---|---|---|---|
| \$20,416,258 | x | 6.392395673/1000 | = | \$130,509 |
| *Source: Walter pers. comm. 2011a, Walter pers. comm. 2011b* | | | | |

Additionally, although public and non-profit lands are not subject to property taxes by local governments, the Department of the Interior (DOI) administers a program called Payment In Lieu of Taxes (PILT), which helps offset the “lost” property taxes to county governments from federally-owned land. In 2011, Chelan County netted \$2,126,841 of PILT money from the DOI for the 1,432,436 acres of federal land within the county. The DOI does not place restrictions on how a county spends PILT funds (See Table III-30: *Payment In Lieu of Taxes to Chelan County from the Department of the Interior (FY2000-2011)*) (DOI, Payment in Lieu of Taxes).

**Table III-30: Payment In Lieu of Taxes to Chelan County from the Department of the Interior (FY2000-2011)**

| Fiscal Year | Total PILT | Fiscal Year | Total PILT |
|---|---|---|---|
| 2000 | \$698,706.00 | 2006 | \$930,046.00 |
| 2001 | \$1,036,813.00 | 2007 | \$940,013.00 |
| 2002 | \$1,131,714.00 | 2008 | \$1,515,401.00 |
| 2003 | \$857,298.00 | 2009 | \$1,614,393.00 |
| 2004 | \$931,388.00 | 2010 | \$1,982,743.00 |
| 2005 | \$896,503.00 | 2011 | \$2,126,841.00 |
| *Source: DOI, Payment in Lieu of Taxes* | | | |

## ***Service-Based Assets***

### Postal Service

The Stehekin Post Office has been operating in the Stehekin Community since 1892 (Vavrek pers. comm. 2011). For at least the last 40 years, the office has operated with limited hours out of an NPS facility at the Stehekin Landing. Under an informal understanding, the NPS does not charge the USPS rent or utilities for the use of the facility. The NPS is working to establish a longer-term agreement with the Postal Service that would allow the NPS to receive compensation for utilities

*15 The Chelan County Assessor lists over 1,045 private acres in the Stehekin Tax District (Walker pers. comm. 2011b). The total assessed value includes only real, not personal (such as a boat), property.*

*16 The 2011 tax rate is 6.392395673/\$1000 assessed value. This is down from 8.39648/\$1000 assessed value in 2000 (Walter pers. comm. 2011b).*

(electricity) used by the USPS to reimburse this use of the NPS owned building (Lesmeister pers. comm. 2011c). Utility costs for 2010 were $1,130.25 (Lesmeister pers. comm. 2011b).

As mentioned previously, the USPS contracts with the Lady of the Lake Boat Company to transport all mail to and from Stehekin. As part of this contract, the USPS provides $81,560.24 (as of December 31, 2011) to the Lake Chelan Boat Company and specifies the mail delivery schedule (Ledbetter pers. comm. 2012, Engstrom pers. comm. 2011). Mail delivery occurs daily (Monday-Saturday) during the summer, with a reduced schedule of three-days-a-week (Monday, Wednesday, and Friday) during the winter. According to the USPS, this "contract is in place to meet [the] service commitments for mail of all types to the customers residing on the contract line of travel. This is the only form of USPS delivery to these customers" (Bruner pers. comm. 2012).

While the Stehekin Post Office does not provide a residential delivery service, residents have access to a post office box free of charge along with a $1.00 deposit for obtaining a key to a P.O. Box (Vavrek pers. comm. 2011). Pacific Crest Trail thru-hikers (those that hike the length of the Pacific Crest Trail) also use the Stehekin Post Office by sending ahead a cache of food and equipment, which is received and stored by the Stehekin Post Office until the hiker claims it.

As mentioned earlier, the USPS employs one postmaster in the Stehekin Valley who, while considered full-time, works part-time throughout the year. The USPS also has two part-time employees who provide relief for the post-master (Kurth pers. comm. 2011b).

The USPS recently went through a process to reduce costs by closing some post offices. The Stehekin Post Office was considered for closure during this process and the decision was made to continue operations (Scherer 2011).

Photo 27 – The Lady of the Lake delivers mail to Stehekin (Michael Silverman).

## Education

The Stehekin School District, Washington State School District number 69, whose sole jurisdiction is the Stehekin Valley, has served as the only public education in the community since 1921. Over the course of this 90 year history, the school has operated in two separate structures. The first was a small, one-room schoolhouse built by a local resident in 1921. In the 1950s, the community built an addition to the schoolhouse to serve as living quarters for the teacher, but it soon became instruction space to accommodate more students. Then again, between 1978 and 1979, another addition to the school was built, an exterior wood shed was constructed, and running water was brought to the structure (NPS 1986). While the original structure remains standing, and has been listed on the National Register of Historic Places since 1974, the State of Washington built a new school in 1988. This new structure and grounds now includes an office, instructional classroom, large community room (used as gym, art room, etc.), kindergarten classroom, bathroom, hallway for "lockers" (rungs for outdoor apparel and backpacks), and two outbuildings.

Since its inception, the Stehekin School has instructed kindergarten through eighth grade in a one-room school setting. While Washington State has always employed at least one full-time teacher to serve the school, in recent years, the school has been able to hire several additional part time teachers, that work between two and 25 hours a week during the school year, to assist with maintenance, administration, kindergarten (now a separate classroom), and general classroom instruction. Other residents volunteer at the school to teach a specific lesson or provide general assistance. In July 2010, the Stehekin School Head Teacher, Ron Scutt, who has served in his current capacity for 37 years, was chosen as the 2011 Regional Teacher of the Year for Washington's North Central Educational Service District (Wall 2010).

The Stehekin School District has five board members and is fully funded by the State of Washington (Scutt pers. comm. 2011a). In the 2009-2010 school year, the Stehekin School District received $15,109 for each of 21 pupils from combined state, federal, and local government funding. In comparison, the per pupil spending in Washington State is $9,522 (Table III-31: *School District Revenues (2009-2010)*) (Office of Superintendent of Public Instruction 2011).

**Table III-31: School District Revenues (2009-2010)**

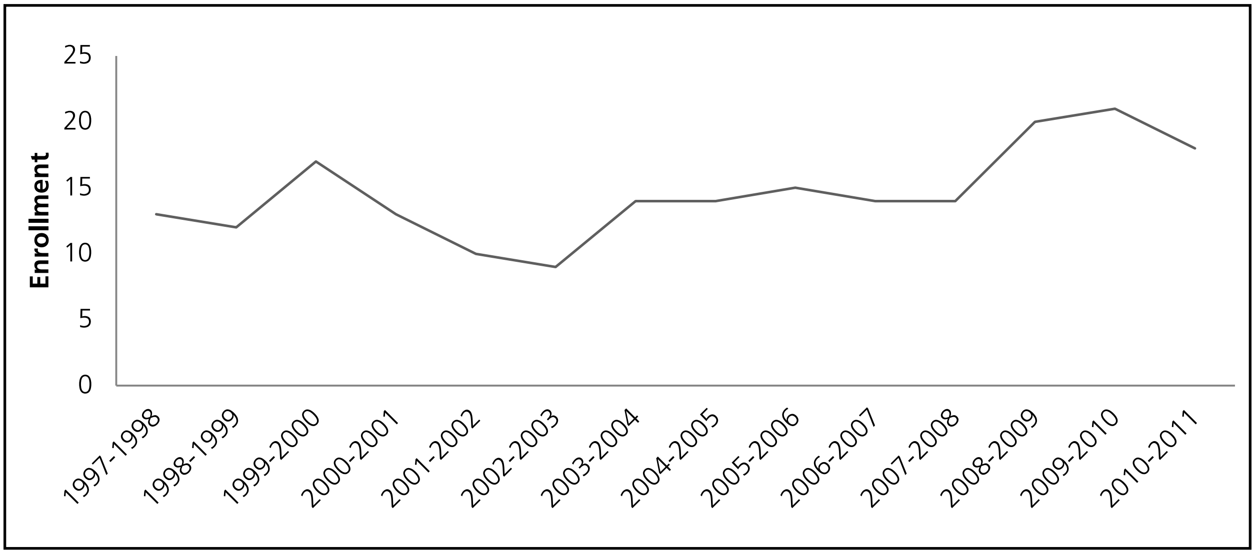
| School District | Per Pupil Revenues | Per Pupil Expenditures |
|---|---|---|
| Stehekin School District | $15,109 | $9,522 |
| Wenatchee School District | $9,309 | $8,824 |
| Washington State | $9.754 | $9,544 |
| *Source: Office of Superintendent of Public Instruction 2011* | | |

Because the Stehekin School is only a primary and partial secondary education facility, upon graduating from eighth grade, many Stehekin families choose to either homeschool their children (some families have chosen to homeschool their children for all grade levels) or move downlake to Chelan, or another town, for the child's high school education. According to the Stehekin School Head Teacher, the school also attracts families from elsewhere in the United States. (Scutt pers. comm. 2011a).

Although, due to low enrollment, the Stehekin School did not operate between the 1940s and end of WWII, enrollment has remained fairly steady in recent years (Figure III-20: *Stehekin School Enrollment (1997-2011)*) (Robertson 1987). Between the 1997-1998 and 2010-2011 school years, average enrollment was 15 students, with 17 students on average in the last five years (Scutt pers. comm. 2011b).

According to the Stehekin School Head Teacher, the school projects a large decrease in enrollment in next few years due to a proportionally high number of older students currently enrolled (who will presumably graduate in the next few years) (Scutt pers. comm. 2011a).

**Figure III-20: Stehekin School Enrollment (1997-2011)**




*Source: Scutt pers. comm. 2011b*

## Emergency Response Services

### *Healthcare and Medical Emergencies*

Although there are no traditional medical facilities in Stehekin (residents travel downlake for physical, eye, and dental appointments, hospital care, etc.), the NPS, along with several private residents respond to medical emergencies in the Valley. The NPS currently has two employees who are certified Emergency Medical Technicians (EMT) and at least one Stehekin resident is a certified EMT.

Between 2004-2011, the NPS responded to approximately 283 medical emergencies in Stehekin, 61 percent of which were for general illness. In another 30 percent of incidents, the NPS provided basic life support, and in eight percent of the incidents, the NPS provided advanced life support (Janda pers. comm. 2012). While most of these emergency medical responses were for visitors to Lake Chelan NRA or for staff of the NPS or NPS concessioner, approximately 27 percent of the emergency medical incidents between 2004-2011 were for Chelan County assists, where the NPS responded to a medical emergency under the jurisdiction of Chelan County. These assists included emergency medical services (EMS) provided to Stehekin residents (who were not visiting Lake Chelan NRA at the time of the incident) and visitors to or residents of Lucerne/Holden Village (located seven miles down Lake Chelan from Stehekin) in the

Okanogan-Wenatchee National Forest (Figure III-21: *Total NPS Response to Emergency Medical Incidents in Lake Chelan NRA (2004-2011)*) (Janda pers. comm. 2012; Warford pers. comm. 2011). (NPS jurisdiction includes all visitors to Lake Chelan NRA regardless of residency (for example a Stehekin resident visiting the recreation area would be included) and all NPS and NPS concessioner staff regardless of whether or not they were on duty at the time of the incident.) These EMS responses in Stehekin have accounted for approximately 63 percent of all EMS responses in North Cascades NPS Complex since 2001 (Warford pers. comm. 2011).

### *Law Enforcement*

In addition to medical emergencies and responses, the NPS also exercises proprietary law enforcement jurisdiction throughout the Complex. In Stehekin, one full-time NPS law enforcement ranger enforces Title 36 of the Code of Federal Regulations and other applicable federal laws. When funding permits, additional seasonal rangers (generalists) assist with visitor and resource protection in Valley (The Complex hired two seasonal rangers for the Stehekin District in 2011). Although Chelan County has primary jurisdiction for search and rescue throughout the county, the NPS Complex often manages incidents at the County's request. Under a Memorandum of Understanding (agreement number G947103113), the NPS and Chelan County Sheriff's office cooperate on a variety of emergency incidents whereby each agency makes a good faith effort to provide available assistance including law enforcement, search and rescue personnel, certified emergency medical technicians, and/or other necessary personnel and equipment to respond to emergencies (Asarian pers. comm. 2011).

Since 2005, of the approximately 1,503 incidents that NPS Law Enforcement staff responded to within North Cascades NPS Complex, approximately 389 incidents (26 percent) occurred in Stehekin. While most of these incidents were a response to visitors within Lake Chelan NRA, the NPS has also performed 27 assists to the Chelan County Sheriff's office since 2006 (as of fall 2011). These responses have ranged from transporting luggage up Lake Chelan from Lucerne, to investigating vehicle tampering and theft, monitoring the Valley for sale of narcotics, and transporting subjects under investigation (Warford pers. comm. 2011).

### *Fire Management*

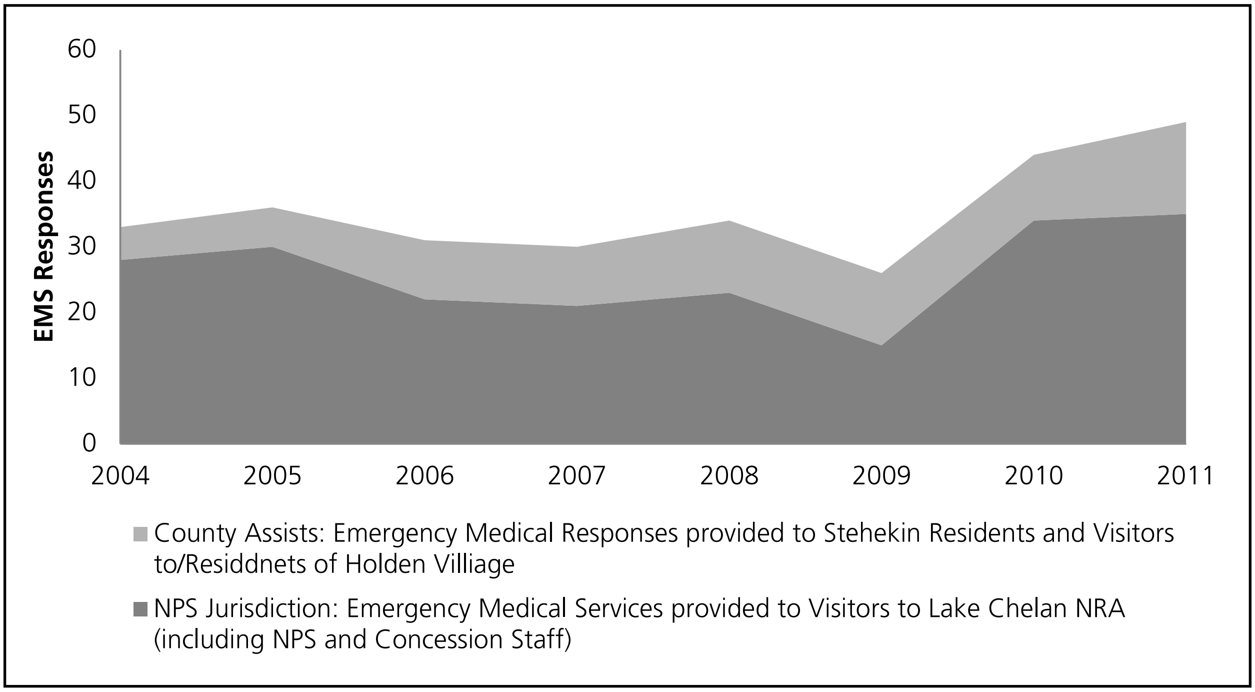
Located on the east side of the Cascades, the Stehekin Valley receives 35 inches of annual precipitation, most of which falls during the winter and spring seasons (see "Climate" in Chapter III, 6a). Due to these dry conditions, steep topography, remoteness, location within miles of contiguous forest, and a history of fire suppression in the Valley, the Stehekin Valley is a federally listed "Community at Risk" for wildfire (Federal Register Vol. 66 number 160, August 17, 2001).

Because of these conditions, North Cascades NPS Complex has a Fire Management Plan. The highest priority under this plan is to address wildland fire threats in Stehekin. To reduce the fuel load in fire prone areas, and thereby reduce the risk of wildland fire in Stehekin, the NPS thins vegetation, removes biomass, performs prescribed burns and monitors fire effects. Through these means, the NPS has treated 3,270 acres[17] in the Stehekin Valley since 2001 at an expense of approximately $1.7 million.[18] Monitoring, planning, and environmental impact analysis are not included in these costs (Figure III-22: *Cost of NPS Fire Program and Fire Incidents in Stehekin Valley (FY2006-2010)*) (Johnson pers. comm. 2010).

*17 An acre is counted once for every treatment it receives. So if one acre received thinning, biomass removal, and an under-burn, it would be represented by three acres in this figure.*

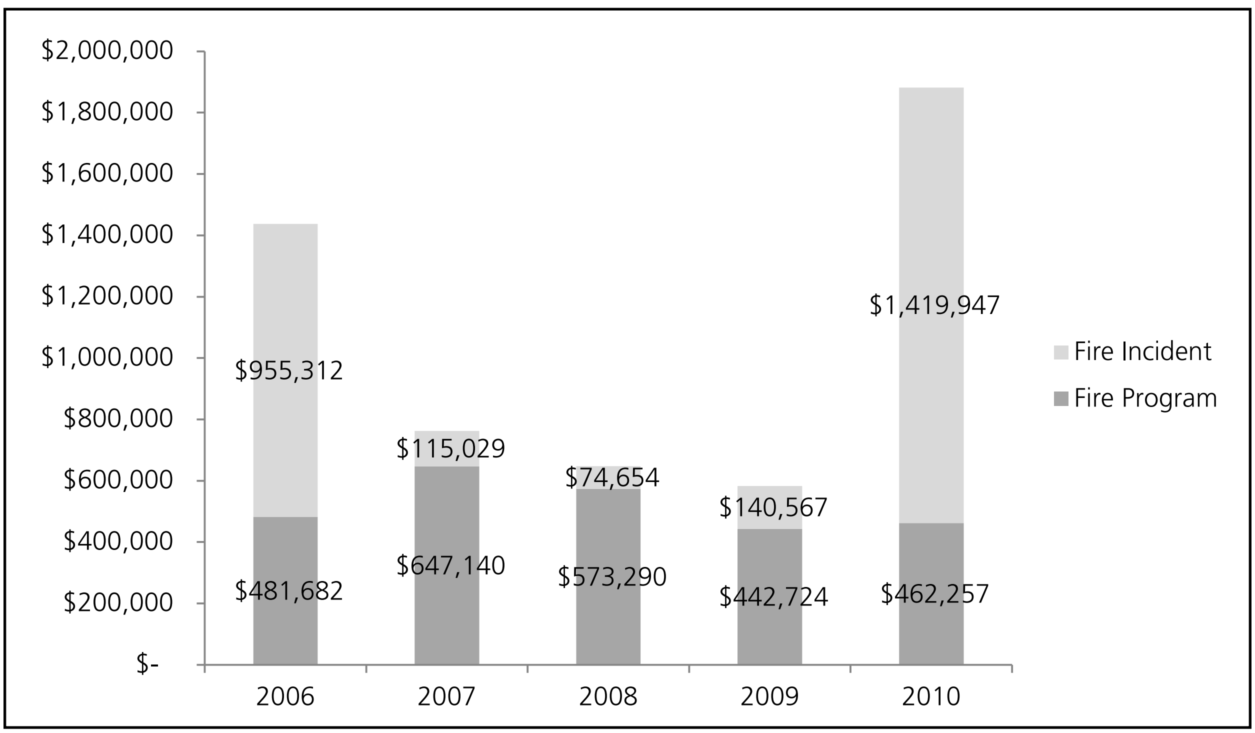
*18 Funding for these services comes to the NPS primarily through the National Fire Plan, with approximately $150,000 from the USDA Forest Health Funding (from Wenatchee Fire Sciences Lab) (Johnson pers. comm.. 2010).*

**Figure III-21: Total NPS Response to Emergency Medical Incidents in Lake Chelan NRA (2004-2011)**




*Source: Janda pers. comm. 2012*

**Figure III-22: Cost of NPS Fire Program and Fire Incidents in Stehekin Valley (FY2006-2010)**




*Source: Kafka pers. comm. 2011*

In addition to the NPS fuels reduction program, there are currently two fire emergency response units in the Valley.

1. In 2007, Stehekin residents created Chelan County Fire District, No.10 run by volunteers from the community. In addition to responding to emergencies, this volunteer group offers FireWise workshops to educate landowners about FireWise principles and practices, organizes annual work parties and coordinates with the NPS to implement fuels reduction efforts around homes. It also improves protection capabilities and seeks to increase human safety by, among other means, providing fire protection materials to homeowners, training residents for the volunteer fire department, obtaining firefighting equipment, and coordinating with local contractors to transport firefighting equipment to needed areas (Concerned Citizens of the Stehekin Valley 2008).
2. The NPS also runs an active fire management program in the Valley that has responded to 24 wildfires in Stehekin since 2006, three of which reached a type two complexity and required an outside team to manage the fire (designated by an asterisk in Table III-32: *Stehekin Wildfires (2006-2011)*). All three of these fires posed a direct threat to structures in the Stehekin Valley. Two of the fires were naturally caused and one fire was human caused (Srok pers. comm. 2011; Ebel pers. comm. 2011). (2009 was a record year for the number of wildfires in North Cascades NPS Complex.)

These incidents over the past five fiscal years have cost the federal government roughly $2.7 million, totaling as much as $1.4 million in one year. These costs go toward paying fire fighters

**Table III-32: Stehekin Wildfires (2006-2011)**

| Year | Fires | |
|---|---|---|
| 2006 | Bridge Creek | Flick* |
| | Rainbow Mountain | Silver Bay Dump |
| | Castle | Weaver |
| 2007 | Little Agnes | Tolo* |
| | Upper Agnes | Dee Dee |
| | Logan | Castle |
| | Bridge Creek | |
| 2008 | Rainbow Bridge | Rainbow Know |
| | Rainbow Scree | |
| 2009 | Weaver PUD | Vija Bridal |
| | Upper Boulder Creek | Castle Ridge #2 |
| | Reynolds | Airport View |
| | Castle Ridge #1 | |
| 2010 | Rainbow Bridge* | |
| 2011 | None (as of 10/1/2011) | |

** These fires reached a Type 2 complexity: they were beyond the capabilities to manage at the local level and an overhead team was brought in to manage the fire.*

*Sources: Skor pers. comm. 2011; Ebel pers. comm. 2011* and transporting workers and equipment. The funds also go directly to the Stehekin community for contracts. For the FY2006, 2007, and 2010 fire incidents, the NPS paid Stehekin businesses a total of $188,595 for feeding and lodging fire crews and another $36,205 for barge and garbage costs associated with the fires (Kafka pers. comm. 2011). Similarly, total costs do not include costs incurred by Washington State for their involvement in wildland fire incidents.

### Community Organizations/Activities

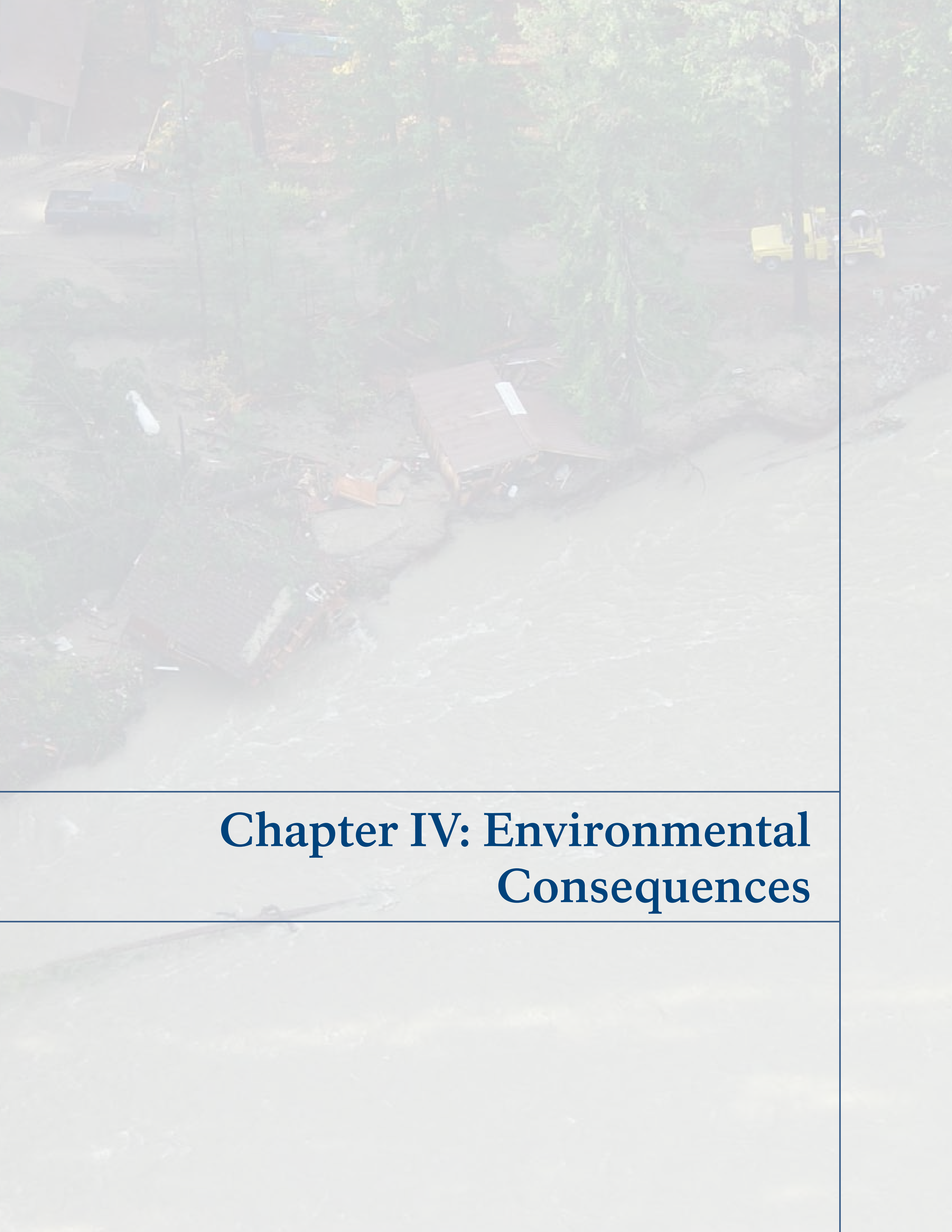
The Stehekin Community is also home to several community organizations and activities. In addition to Arts and Humanities of Stehekin (operates the Gallery in the Golden West Visitor Center), the Craft Shop Cooperative (associated with the House that Jack Built – a craft shop and NPS concessioner) and other girl and boy scout groups, one organization, the Stehekin Heritage Defense Committee, operates as a 501c3 organization under the IRS (IRS 2012). The community also has an online newspaper and five community members serve on the board of the school district.

The community also hosts several festivals and activities every year, including: the Trillium Festival, Summer Music Weekend, spinning rendezvous, school events (graduations), Christmas singing, choir, church events, horse shows, scouting, archery shoots, and Mother's Day picnics.

Photo 28 – Buckner Orchard Harvest Fest (Herb Sargo).

Many of these organizations and activities operate out of the Community Hall, Washington State's first fish hatchery (the building was donated to the community when the operation closed). While this is a self-operating facility (community members can sign up on the calendar to use the building), every year the community comes together to clean the facility and chop fire wood for the winter (Vavrek pers. comm. 2011). There are also two churches located in Stehekin (Vavrek pers. comm. 2011).

Overall, there is a vibrant social network among permanent and seasonal residents in Stehekin. In addition, the community is a part of the visitor experience; visitors to Lake Chelan NRA come in part to experience and interact with members of the community.



# Chapter IV: Environmental Consequences

**Destruction of private cabin and damage to upper end of Company Creek Road during the 2003 flood.**

# CHAPTER IV: ENVIRONMENTAL CONSEQUENCES

This chapter describes the impacts of each alternative on Lake Chelan NRA resources, including cumulative impacts. Methods used for the analysis are presented in the "Impact" sections and provide information about methodology common to all impact sections. An expanded Methodology section is contained under each Impact topic. Similar to Chapter II: *Management Alternatives*, this chapter contains an Impact Comparison Chart (Table IV-16 at the end of this chapter) to compare the differences in projected impacts among the alternatives.

## A. INTRODUCTION

The National Environmental Policy Act (NEPA) requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented. (In this document, "effects" and "impacts" are used interchangeably.) This section analyzes the environmental impacts of project alternatives on affected resources. These analyses provide the basis for comparing the effects of the alternatives. NEPA requires consideration of context, intensity, and duration of impacts, indirect impacts, cumulative impacts, and measures to mitigate impacts. In addition to determining the environmental consequences of the preferred and other alternatives, National Park Service (NPS) *Management Policie*s *2006* (NPS 2006a) and Director's Order 12 (NPS 2001a) require analysis of potential effects to determine if actions would impair park resources. The basis for understanding the analysis within this chapter is provided below.

### 1. Methodology

This section describes the terms that are used in evaluating environmental impacts.

**Context of Impact:** The context is the setting within which impacts are analyzed—such as the project area or region, or for cultural resources, the project action area or *area of potential* effects (APE).

**Type of Impact:** The type of impact is a measure of whether the action will improve or harm the resource and whether that harm occurs immediately or at some later point in time.

- **Beneficial:** The impact improves the resource or the quality or quantity of the resource.
- **Adverse:** The impact harms or depletes the resource or its quality or quantity.
- **Direct:** The impact is caused by and occurring at the same time and place as the action.
- **Indirect:** The impact is caused by the action, but occurs later in time, or at another place, or to another resource.

**Duration of Impact**: Duration is a measure of the time period over which the effects of an impact persist and may be short term (quickly reversible and associated with a specific event, such as construction, during project implementation) or long term (reversible over a much longer period or may occur continuously based on normal activity).

**Area of Impact:** Impacts may be localized, detectable only in the vicinity of the activity, or widespread, detectable on a regional or landscape level.

**Intensity of Impact:** In this document, the intensity of impacts is measured using the following scale: negligible, minor, moderate, and major. These are defined for each resource within the analysis sections. In addition, determinations of effect for actions that would affect threatened or endangered species comply with Section 7 of the Endangered Species Act (ESA) (no effect; may affect, not likely to adversely affect; and may affect, likely to adversely affect), while determinations of effect for cultural resources also comply with Section 106 of the National Historic Preservation Act (NHPA) (no historic properties affected, no adverse effect, and adverse effect).

**Impact Mitigation:** Impacts have been assessed under the assumption that proposed measures to minimize or mitigate the impact would be implemented. The following terms identify the way to change the intensity of impacts or to change the resource condition following impacts. Project actions can:

- **Avoid** conducting management activities in an area or at a time that affects the resource;
- **Minimize** the type, duration, or intensity of the impact to an affected resource; and
- **Mitigate** the impact by:
    * **Repairing** localized damage to the affected resource immediately after an adverse impact.
    * **Rehabilitating** an affected resource with a combination of additional management activities.
    * **Compensating** for a major long-term adverse direct impact through additional strategies designed to improve an affected resource to the degree practicable.

## 2. Cumulative Impacts

The Council on Environmental Quality (CEQ) describes a cumulative impact as follows (Regulation 1508.7):

A "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The cumulative projects addressed in this analysis include past and present actions, as well as any planning or development activity currently being implemented or planned for implementation in the reasonably foreseeable future. Cumulative actions are evaluated in conjunction with the impacts of an alternative to determine if they have any additive effects on a particular resource. Because most of the future cumulative projects are in the early planning stages, the evaluation of cumulative impacts was based on a general description of the project. These projects are included in the cumulative effects analysis presented in this chapter (see Appendix 5: *Cumulative Impacts Project List*).

Past actions included in the Cumulative Impact Analysis include ongoing maintenance on the Company Creek and Stehekin Valley roads as well as the following projects:

## Company Creek Road (CCR)

**CCR Mile 1.9:** Maintain levee (built in 1981), two bank barbs (1997) to protect Company Creek Road from inundation. Although the levee is currently in fair to good condition, it is anticipated that over time additional repairs to maintain it will need to be made. These repairs would likely consist of measures similar to those described above, such as reconstruction of rock barbs, replacement of portions of the levee structure, and additional bioengineering or riparian restoration.

**CCR Mile 2.1:** Maintain of six barbs and bioengineering constructed in 1997 to implement the *Erosion Control on Company Creek Road Environmental Assessment* (NPS LACH 1997). In 1997, four bank barbs and bioengineering were placed at Milepost 2.1 to protect the Company Creek Road from Stehekin River flood-related erosion. One of these barbs has since been buried, while three remain. Over time it is anticipated that these barbs will also be buried, necessitating their reconstruction as the riverbed continues to aggrade (increase in height). A fifth barb, placed on private land, has also been largely buried.

**CCR Mile 2.2:** Maintain hump in road to allow water to run off the road, rather than down the road. In 2004, a road hump was placed within the Company Creek Road as part of emergency repairs that followed flooding in 2003. This road drainage feature allows water to run off into natural flood channels off Company Creek Road. Over time, it may require replacement or repair.

**CCR Mile 2.2 - 2.4:** Maintain three grade-control structures in road constructed as an action which implemented the *Minimize Erosion on Upper Company Creek Road Environmental Assessment* (NPS LACH 2007). In 2007, three grade-control structures were constructed adjacent to the Company Creek Road to prevent head-cutting along the bank of the Stehekin River from affecting the Company Creek Road. Additional changes in the bank of the Stehekin River could necessitate the repair or reconstruction of these grade-control structures, which are designed to allow floodwater to pass through the floodplain without cutting large channels.

**CCR Mile 2.2 - 2.4:** Maintain four rock barbs and bioengineering built in 2007 as part of the 2007 Environmental Assessment *Minimize Erosion on Upper Company Creek Road Environmental Assessment* (NPS LACH 2007).

## Stehekin Valley Road

Numerous erosion management and one major flood control measures have been constructed by the NPS along the Stehekin Valley Road. Under all alternatives (1-5) these measures would continue to be maintained and would be enhanced if necessary.

**SVR Mile 2.8:** Maintain four rock barbs and bioengineering constructed in 1997 as part of the *Erosion Control on Company Creek Road Environmental Assessment* (NPS LACH 1997).

**Stehekin Valley Road Improvement Project (NPS LACH 2005a):** There are some measures that have not yet been implemented from the selected action in the *Stehekin Valley Road Implementation Project Environmental Assessment* (NPS LACH 2005a) that would be included in all alternatives in the SRCIP. Those measures that have not yet been implemented from the selected action in the Stehekin Valley Road Improvement Project Environmental Assessment and FONSI (NPS LACH 2005a) would either be included in all alternatives or have been modified in the action alternatives based on new information and are explained below. Impacts of these modified actions are the same as were described in that EA/FONSI.

These measures include rehabilitation of the road from Harlequin Bridge to Milepost 9.2, surfacing of the road, the need for installing erosion protection measures at Milepost 5.3 (Wilson Creek) (although these now vary among the alternatives), and construction of new pullouts and a winter turnaround / parking area. Because of the proposed reroutes, other measures from that EA, such as the grade raise in McGregor Meadows, would only be implemented as part of Alternative 1 or 4 (see "Description of Alternatives 1 - 5" for each alternative discussed in Chapter II: *Management Alternatives*).

**SVR Mile 7.0:** As part of the *Stehekin Valley Road Improvement Project* implementation of the Milepost 7.0 and 7.5 reroutes, grade-control structures were constructed to inhibit the Stehekin River from flowing down the road. The largest grade-control structure (at Milepost 7.0) is 300 feet long and six feet wide (1,800 square feet or 0.04 acres) (beneath the road). The other two are slightly wider than the road (1214 feet), approximately 16 feet by six feet (96 square feet) (0.004 acres) and spread 50 yards apart downstream. These three grade-control structures would continue to be maintained.

**SVR Mile 8.0:** Maintain two rock barbs and bioengineering (1993), and four additional rock barbs and bioengineering (2007) constructed as part of the *Stehekin Valley Road Improvement Project*. Approximately 800 linear feet of streambank has been affected, with approximately 12,000 square feet (800 feet × 15 feet) (0.28 acre) of bioengineering. Over time, additional maintenance of the rock barbs, including potential reconstruction, would be needed.

**SVR Mile 9.2:** Continue to monitor threats to Stehekin Valley Road and maintain existing grade-control structures that limit the potential for water to create a channel in the road corridor (see also proposed actions at this site in Alternatives 2 - 5). Following rapid bank erosion just upstream during the 2006 flood, two grade-control structures were installed where the road meets the river.

**SVR Mile 9.1 - 10.2:** Maintain existing culverts, bioengineering, and cabled logs. In 2003, catastrophic loss of the Stehekin Valley Road occurred in this area and an upper road reroute was selected from among the alternatives described in the Coon Run EA that evaluated options for this portion of the road (NPS LACH 2005b). Because the road reroute continues to traverse the edge of the floodplain, there is a potential that future additional repairs or modifications to the road and/or associated erosion control structures could be needed.

## Context and Duration for Impacts Evaluated in the Stehekin River Corridor Implementation Plan

(Except where inserted in the sections below, the context and duration is as follows for all resource impact topics.) Direct, indirect and cumulative impacts are evaluated in terms of context and duration.

**Context of Impact:** Changes were considered within the lower Stehekin Valley below High Bridge to Lake Chelan in the nonwilderness portion of Lake Chelan National Recreation Area (Lake Chelan NRA).

**Duration of Impact:**

- **Short term:** These impacts are often quickly reversible and associated with a specific event, such as construction, during project implementation, occurring for a period of less than one to five years.
- **Long term:** These impacts are reversible over a much longer period, may occur continuously based on normal activity, or may occur for more than five years.

## Impacts Associated with Future Proposed Materials Sources, Staging, or Spoils Areas

Contractor-selected noncommercial material sources, staging, or spoils areas not identified within this document for project work would, at a minimum, have written documentation submitted by the contractor prior to any use to ensure that potential effects on rare, threatened, or endangered species (ESA), waters of the United States (Clean Water Act (CWA)), or prehistoric or historic resources (NHPA) have been evaluated in association with the proposed activity or activities.

# 3. Impact Assumptions

The NPS and FHWA have used the design process to reduce impacts. For example in this project, the road design includes measures such as locating pullouts away from sensitive nesting areas, avoiding the removal of large nest or perch trees where possible, and minimizing cleared areas. FHWA also designed the project to limit the importation of new material by balancing cut and fill amounts in each design.

Acreage impacts and other quantified impacts provided within the analysis are preliminary. This information is provided to convey the relative differences in impacts among alternatives and is from multiple sources, including the 30 and 75 percent road designs provided by the Federal Highway Administration (FHWA) to the North Cascades NPS Complex. Final impact numbers would likely be within ten percent of the numbers provided in Table IV-1: *Some Quantified Impact Assumptions* and throughout this document. Estimated road impacts have generally been rounded to the nearest half or whole acre, although some more specific differences are given within, depending on the impact being discussed. Impacts associated with erosion protection measures and recreational features have been derived from designs based on the anticipated area that would be affected. Implementation of these measures would have similar impacts but could be slightly more or less than the approximate impact figures identified.

**Table IV-1: Some Quantified Impact Assumptions**

| Action | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 (Preferred) |
|---|---|---|---|---|---|
| Stehekin Valley Road proposed paving mileage | 9.2 miles | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 |
| Stehekin Valley Road rehabilitation mileage (Harlequin Bridge to Winter Turnaround) | 4.9 mi | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 |
| Actual Area Affected by Rehabilitation (road length × 14 ft Alt 1, 16 ft Alt 2 - 5) | 8.3 ac | 9.4 ac | Same as Alt 2 | Same as Alt 2 | 9.6 ac |
| Site-specific road improvements (pullouts, winter turnaround, Wilson Creek, Thimbleberry Creek) | 2.3 ac | 2.4 ac | 2.4 ac | Same as Alt 1 | Same as Alt 2 |
| Stehekin Valley Road Reroute | N/A | 13 ac | 13 ac | N/A | 13 ac |
| Reroute Access Connector | N/A | N/A | N/A | N/A | 1.0 - 1.2 ac (0.2 mi) |
| McGregor Meadows Access Road | N/A | 1.3 ac (0.8 mi) | Same as Alt 2 | N/A | Same as Alt 2 |
| Estimated lands available for exchange | 37 ac | 24 ac | Same as Alt 2 | Same as Alt 2 | 29 ac |
| Number of barbs (acres) | 0 | 6 - 8 (0.5) | 4 (0.3) | 16 - 17 (1.1) | Same as Alt 2 |
| Number of logjams (acres) | 0 | 2 (0.1) | 5 (0.3) | 3 (0.1) | Same as Alt 2 |
| Maintenance / housing relocation | 5 - 8 ac | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 | Same as Alt 1 |
| Recreational improvements | 3.1 ac | 3.6 ac | 3.4 ac | 3.5 ac | Same as Alt 2 |
| **Restoration** | | | | | |
| a. Riparian | 1.5 ac | 4.1 ac | 3.9 ac | 2.9 ac | Same as Alt 2 |
| b. Upland | 3.6 ac | 4.4 ac | 3.7 ac | 3.7 ac | Same as Alt 2 |
| c. Bioengineering (barbs and logjams) | n/a | 0.6 ac | 0.6 ac | 1.2 ac | Same as Alt 2 |
| Total restoration (a+b+c) | 5.1 ac | 9.1 ac | 8.2 ac | 7.8 ac | 9.1 ac |
| **Total disturbance** | | | | | |
| | 10 ac (new)<br>37 ac (LPP)<br>12 ac (existing) | 23 ac (new)<br>24 ac (LPP)<br>8 ac (existing) | 23 ac (new)<br>24 ac (LPP)<br>9 ac (existing) | 11 ac (new)<br>24 ac (LPP)<br>12 ac (existing) | 24 ac (new)<br>29 ac (LPP)<br>8 ac (existing) |

## 4. Additional Assumptions

- Implementation of the management actions proposed in this plan largely depends upon continued federal funding of NPS programs and projects.
- Some of the funding to implement this plan would be spent locally in Stehekin in the form of contracts for services such as road maintenance and repairs, facility construction and miscellaneous goods and services. The percentage of funding that would be spent in the local or regional area however is not known, because it would depend on many factors that will not be known until contracts are put out to bid.
- Over the lifespan of this plan, most of the privately owned land in Stehekin would remain private.
- Future funding for land exchange and acquisition under the Land Protection Plan is uncertain and cannot be quantified. Congressional appropriations from the Land and Water Conservation Fund would be the primary source of funding to facilitate lands-related actions (e.g. land exchanges, purchase or easement acquisition).
- The NPS desire to protect the natural resources and values of Lake Chelan NRA, including the resources and values associated with the Stehekin River, may translate into an interest in flood-threatened land that may not exist in the private real estate market.
- Awareness of flood risk is likely to influence the choices that individuals and businesses may make to avoid harm in the future. These choices may include working with the NPS to avoid the flood risk through land exchanges, acquisition of private land or easements.
- NPS land protection policies would continue to guide a program based on the willing seller/ willing buyer authority as provided by the Enabling Legislation for Lake Chelan NRA. Land acquisition, land exchange, or easement acquisition would only occur if initiated by private landowners.

# B. ENVIRONMENTAL IMPACT ANALYSIS

## 1. Land Use Impacts

### Land Use Methodology

**Methodology:** Land use analysis was based on a quantitative and qualitative assessment of the potential changes to lands within the project area encompassed by the alternatives. The amount of undisturbed natural landscape / recovering landscape was compared to proposals for potential new development and changes associated with existing development.

**Type of Impact:** Types of land use changes considered include conversion from undeveloped land to developed land and additional protection of undeveloped or restored lands as public lands. The extent to which an area has been previously impacted by human activities is also considered. Beneficial impacts would result from sustainable future development out of the channel migration zone, protection of undisturbed land, and restoration of lands now developed to natural conditions. Adverse impacts would result from development remaining in the channel migration zone or new development in previously undisturbed areas. Indirect impacts could result from retention of the Stehekin Valley Road. Indirect impacts would also be associated with impacts from changes to lands identified by the LPP (NPS LACH 1995b) for exchange since identifying lands for exchange would not necessarily mean that they would be developed.

**Intensity of Impact:**

- **Negligible:** Impacts would be imperceptible or not detectable.
- **Minor:** Impacts would be slightly detectable or localized within a small portion of the project area.
- **Moderate:** Impacts would be readily apparent.
- **Major:** Impacts would be substantial, highly noticeable, and widespread. Changes to the character of the Stehekin Valley would occur.

## Land Use Impacts

The following proposed plan components would affect land use in Alternatives 1 - 5:

- Introducing recreation facilities, relocating maintenance / housing, adding erosion protection measures, and offering exchange lands in currently undeveloped areas
- Relocating a portion of the Stehekin Valley Road in Alternatives 2, 3 and 5 or raising the grade of a portion of the Stehekin Valley Road in McGregor Meadows in Alternatives 1 and 4
- Changes to the 1995 LPP (Alternatives 2 - 5) to allow clustering of development and to provide a more sustainable land area not as susceptible to flooding, and in Alternative 5, not as susceptible to debris flow hazards.

These actions would change the amount of undisturbed native landscape compared to the amount of restored native landscape and developed lands. While other actions, such as road rehabilitation, erosion protection measures, and recreational development, would have negligible to minor effects, these key components of the proposed plan would account for most impacts.

### *Impacts from Actions Common to Alternatives 1 - 5*

#### Maintenance Facility and Housing Replacement and Relocation

Alternatives 1 - 5 would implement the General Management Plan (GMP) direction to remove administrative facilities from the floodplain. Approximately 5 acres now used for the NPS maintenance complex within the 100-year floodplain / channel migration zone of the Stehekin River would be consolidated with relocated administrative housing on five to eight acres of uplands near the airstrip in Alternatives 1-4 and elsewhere in the lower valley in Alternative 5. The Stehekin airstrip is located on an alluvial fan above the 100-year floodplain and out of the channel migration zone. Most of the area surrounding it has been previously disturbed (cleared). The maintenance facility move would allow for the removal of hazardous waste storage facilities and outdated septic systems from within the 100-year floodplain to high ground, where more suitable site conditions exist to accommodate these facilities. Building materials would be salvaged where possible and most of the area would be restored to natural conditions, a long-term moderate to major beneficial effect.

The replacement and relocation of the maintenance facility would result in the restoration of lands within the 100-year floodplain and channel migration zone of the Stehekin River, including a wetland. It would also provide for the long-term persistence of the facilities because these would no longer be affected by flooding. The Stehekin River would benefit from the removal of facilities that contain numerous point sources of potential pollution, including from heavy equipment; electrical appliances; storage of cleaning materials and supplies, furnishings, and building materials, such as paints and solvents; and a solid-waste storage facility. These facilities have flooded approximately every other year (most recently in 2006). Because the facility would be designed to silver or greater LEED rating, it would provide efficient, green building design intended to be a low impact development. Unlike the current maintenance complex, buildings would be located close together and would be landscaped with native plants. Circulation spaces would be designed in concert with buildings and would contribute to efficient use that would further reduce the effects of development. Although some small structures in the old maintenance area could be relocated and repurposed, their removal from the 100-year floodplain would bring the facility into compliance with Executive Orders, NPS policies, and North Cascades NPS Complex plans.

Overall, there would be minor to moderate adverse effects on land use from the development of an additional five to eight acres of upland within the lower Stehekin Valley. These effects would be offset by the moderate long-term beneficial effect from removing approximately 5 acres of development from within the 100-year floodplain and channel migration zone of the Stehekin River.

#### Recreational Facilities

**Campgrounds:** A long-term minor adverse impact on land use would occur from the establishment of new campsites at Bullion. Negligible beneficial effects would occur from the conversion of Bullion Camp to a day-use area.

### *Impacts from Alternative 1*

#### Road Grade Raise

Realigning and raising the grade of the Stehekin Valley Road within McGregor Meadows would continue to raise floodwater surface elevation on private land in McGregor Meadows by limiting flow from the river to its floodplain, including a side channel on the northeast side of the road. Retention of the road would continue to have long-term localized moderate adverse effects on land use. Other indirect effects on land use from retaining the road would occur over time as actions were taken to protect the road by adding new erosion protection measures.

#### Retention of the Stehekin Valley Road

Maintaining the Stehekin Valley Road in place could also continue to encourage unsustainable development in the channel migration zone, a localized long-term moderate to major adverse impact.

#### Implementation of 1995 Land Protection Plan

The NPS would continue to implement the 1995 LPP (NPS LACH 1995b) and the GMP direction to encourage relocation of private development out of the 100-year floodplain of the Stehekin River. The priorities for land protection (primarily acquisition and exchange) would remain the same. The criteria used to rank properties for acquisition and exchange would continue to be focused on removing development from the 100-year floodplain and on protecting scenic qualities as viewed from the Stehekin Valley Road, as well as on protecting key natural resources associated with water. This effort would be limited by outdated floodplain maps that include areas mapped outside the floodplain that now flood frequently.

The NPS would also continue to have limited ability to influence the nature and extent of development on private lands within the Stehekin Valley. Development constraints and conditions would continue to be regulated by Chelan County and would generally be one dwelling per 5 acres (under current zoning). Some parcels were previously divided into one-acre lots, which were considered buildable before current zoning was enacted. Most of these smaller parcels are located near the river mouth in the channel migration zone. Additional permitted uses include, but are not limited to, home occupations, bed-and-breakfast establishments, guest inns, recreation or tourist uses, and small-scale businesses. Construction constraints would continue to include conformity to the Shoreline Management Act and zoning in the Chelan County Plan and appropriate setbacks from the Stehekin River to protect environmental quality.

Ongoing NPS review of development within the lower Stehekin Valley (including exchanges and new lands) would include planning and pre-design; preliminary and final design; construction and monitoring; and maintenance and compliance actions, including regular inspection of applicable property by the NPS for compliance with Conditions, Covenants and Deed Restrictions (CCRs) (Appendix 9).

As noted in Chapter II: *Management Alternatives*, the tracts proposed for exchange in the 1995 LPP (approximately 37 acres) would remain possible for exchange at some later date (see Chapter II: *Management Alternatives*, Table II-4: *1995 Land Protection Plan Proposed Exchange Parcels*). Of these 37 acres, one combined parcel (part of 08-100) is primarily located within the floodplain and does not have enough buildable area. As a result, there would be approximately 35 acres that could be developed after exchanges. As many as 114 acres in high-priority acquisition, with no cap on the number of acres, could be affected by acquisition, exchange, easements, or covenants. Therefore the total acreage of public lands could increase slightly.

There are currently 168 privately owned tracts on 417 acres. Although there are approximately 62 high-priority, 18 moderate-priority, and 86 low-priority properties in the LPP that are targeted for fee, easement, or a combination land protection strategy by the NPS, given the history of land acquisition and exchange in Stehekin over the past 16 years, it is likely that most of the remaining 417 acres of privately owned land in Stehekin would remain private. Therefore, there could be ongoing long-term minor to moderate indirect adverse effects on land use from development of some of this land in the channel migration zone. Long-term moderate adverse effects would also be associated with potential exchange of the 20 acres of the Lower Field parcel because there is currently no development at this site. Additional minor to moderate localized beneficial effects could occur from land acquisition of other high-priority lands or protection of exchange lands.

### Recreational Facilities

**Lower Valley Trail:** The conversion of approximately 6.1 miles of existing trail (1.5 acres) to hiker / equestrian trail would have no effect on land use since the trail currently exists. Construction of 6.3 miles of new trail (1.5 acres) would result in a change in land use from development of the trail. This action could have long-term minor adverse effects from increased use of public lands that would affect McGregor Meadows and some areas between the Boulder Creek and Rainbow Creek alluvial fans.

### *Impacts from Actions Common to Alternatives 2 - 5*

#### Recreational Facilities

**Lower Valley Trail:** In Alternatives 2 and 3, approximately 4.6 miles of existing trail (1.1 acres) would be converted to hiker / equestrian trail. Another 7.9 miles of existing trail or former roadway would also be used, including some former Stehekin Valley Road (proposed McGregor Meadows Access Road) and other abandoned road restoration areas. Construction of 4.6 miles of new trail could result in long-term minor impacts from development of the trail.

**Campgrounds:** A long-term minor adverse impact on land use would occur from the establishment of new and modified campsites (Purple Point and Rainbow Falls in Alternatives 2 - 5, and Company Creek in Alternatives 3 and 4).

#### Restoration and Bioengineering

Although restoration would vary among alternatives, there would be long-term negligible adverse effects and long-term minor to moderate beneficial effects on land use from the conversion of former developed areas to restored landscape. In addition to restoration of former housing and maintenance areas, there would be riparian restoration at Lower Field and Buckner Homestead hayfield and pasture as well as restoration of riverbank areas from bioengineering associated with rock barbs and logjams. The benefits of restoration would be greatest in Alternatives 2 and 5, followed by 3, and 4.

### *Impacts from Actions Common to Alternatives 2 - 4*

#### Land Protection Plan Modifications

The key goal of the 1995 LPP (NPS LACH 1995b) has been changed in the revised 2010 LPP to protect lands of high resource value within the Stehekin River channel migration zone. As a result, there would be new criteria to establish priorities for acquisition and exchange. The nine criteria would be weighted more toward protection of the Stehekin River than scenic qualities along the Stehekin Valley Road and general natural resources preservation. Therefore, although the NPS would continue to implement the GMP direction to move private property out of the 100-year floodplain of the Stehekin River, under Alternatives 2 - 4 that focus would be expanded to removing development from the channel migration zone, including areas subject to frequent flooding in McGregor Meadows. This would cause some low-priority properties (those with development) to become high-priority properties to facilitate their exchange or acquisition. Acquisition and exchange priorities would therefore be focused on encouraging the relocation of private residential development from the channel migration zone, which would have long-term moderate (Alternative 4) to major (Alternatives 2, 3 and 5) beneficial impacts on land use from increasing sustainable development. Although the criteria would be weighted differently in Alternatives 2 and 3 versus Alternative 4 to reflect different land use patterns, beneficial impacts would occur in all alternatives, although to a lesser degree in Alternative 4 (see “Additional Impacts” sections below).

In Alternatives 2 - 4, most public land within Lake Chelan NRA would continue to remain in public ownership. Of the total current acreage (roughly 62,000 acres), only 24 acres, or 0.04 percent, would be offered for exchange. This total is much less than the total number of private lands remaining in the Stehekin Valley (417 acres). The 24 acres that would be available for exchange in the proposed revision to the LPP is also less than the approximately 37 acres remaining under the 1995 LPP (in Alternative 1). This plan, however, does not preclude future NPS managers from identifying new exchange lands.

It is unlikely that these NPS exchange lands would be exchanged for a similar number of acres of private land because development actually increases the value of the land. Therefore it is possible that the amount of private land could grow by a few acres through the exchange process. Direct acquisition, however, would reduce the amount of private land. Overall the loss of public land would be small in comparison to the total number of acres preserved in public ownership in Lake Chelan NRA and in surrounding national forests and North Cascades NPSComplex and would have a minor beneficial effect on land use from allowing more sustainable development and from the protection of additional sensitive areas.

In total, approximately 24 acres of public land would potentially be exchanged for private land in Alternatives 2 - 4 and 29 acres in Alternative 5 (Table II-6: *Alternatives 2 - 4 Revised Land Protection Plan Proposed Exchange Parcels*). Given the small amount of land acquisition and exchange in Stehekin over the past 16 years, most of the remaining privately owned land in Stehekin would remain private. Even though this is consistent with the purposes of Lake Chelan NRA, there would continue to be long-term minor to moderate adverse effects on land use from additional conversion of undeveloped land to developed land. This would be coupled with minor long-term beneficial impacts on land use from the potential protection of additional land from other acquisition methods. Conversion of some developed land to its natural state through restoration would also be a long-term beneficial effect.

### *Additional Impacts from Alternative 2*

In addition to the impacts from actions common to all Alternatives (1 - 5) and impacts from actions common to Alternatives 2 - 5, there would be impacts to land use from the road reroute, erosion protection measures, new recreational facilities, and changes associated with the revised 2010 LPP.

#### Road Reroute

Approximately 13 acres of undisturbed land could be affected by a road reroute, a major adverse effect on land use that would be partially offset by restoration of some of the old roadbed and revegetation of cut and fill areas over time (Table IV-1: *Some Quantified Impact Assumptions*). There would be no effect on floodwater surface elevation from the road reroute. In addition, a portion of the existing Stehekin Valley Road alignment would be maintained as the McGregor Meadows Access Road, but the remaining portion (approximately 0.7 mile, or 1.4 acres) of road along the river would be restored, a long-term minor beneficial effect on land use.

#### Erosion Protection Measures

Implementing erosion protection measures at three sites would increase the sustainability of the Stehekin Valley Road, a long-term minor beneficial effect. With the exception of the erosion protection near the river mouth, the other two sites (Wilson Creek and Frog Island) are at the edge of the channel migration zone where the river's ability to migrate laterally is naturally constricted. As a result, actions at Wilson Creek and Frog Island would have no impact on land use or the river's ability to occupy its channel migration zone.

#### Recreational Facilities

**Raft Launch:** A small area of land near the mouth of the Stehekin River (which currently has rip-rap) would be used for a river access point, parking area, and access road. Construction of this public access point to the river, surrounded by private land, is near where this activity now occurs informally and would have both localized minor beneficial and moderate adverse effects on land use. Beneficial effects could also result from consistent and defined public use, in contrast to the current random use pattern; adverse effects would occur from development of this site.

#### Land Protection Plan Modifications

In Alternative 2, the nine criteria would be used as shown in Chapter II: *Management Alternatives*, Table II-5: *Proposed Criteria Weighting to Determine Land Protection Plan Priorities for Alternatives 2 and 3 and Alternative 4*. In the 2010 revised LPP, there would be 66 high-priority properties (totaling 271.50 acres), and 98 medium-priority properties (totaling 141.22 acres), while four properties (4.75 acres) would be low priority for exchange or acquisition. These high-priority properties could be acquired through acquisition, exchange, easements, or covenants or could remain private. As noted above, because most lands would remain private and most impacts would convert private lands from undeveloped to developed, there would be minor to moderate long-term adverse effects on land use. Where additional private lands remained undeveloped or were protected by acquisition, easements, or covenants from exchange, or where exchanged lands were restored, there would be long-term minor to moderate beneficial effects on land use.

### *Additional Impacts from Alternative 3*

In addition to the impacts from actions common to all alternatives (Alternatives 1 - 5) and impacts from actions common to Alternatives 2 - 5, the road reroute (13 acres converted from forest to road) would continue to have a moderate to major adverse effect because a portion of it would remain in the floodplain / channel migration zone; erosion protection measures at five sites would provide a long-term beneficial effect by fostering sustainable land use patterns; one new camp would have a long-term negligible adverse effect; and there would be the same impacts from the implementation of the LPP modifications (including both long-term minor to moderate beneficial and adverse effects) as explained in Alternative 2.

### *Additional Impacts from Alternative 4*

Actions and impacts would be the same as in Alternative 1 for the road grade raise and the same as Alternative 3 for campgrounds, and the same as Alternative 2 for the new river access point.

#### Erosion Protection Measures

Installation of 16 - 17 rock barbs at seven sites would provide a minor long-term beneficial effect by creating more stable land use, but would also continue to allow the road to remain in an unsustainable location within the channel migration zone at several sites. If these erosion protection measures failed, there would be long-term moderate adverse effects from the need for their reconstruction or for road reroutes.

### Land Protection Plan Modifications

As noted above, the LPP would be revised to identify new priorities for acquisition and exchange based on nine criteria weighted less toward protection of the Stehekin River than in Alternatives 2 and 3. Although these criteria and actions associated with the LPP would be the same as in Alternatives 2 and 3, the criteria would be weighted differently in Alternative 4, as shown in Chapter II: *Management Alternatives*, Table II-5: *Proposed Criteria Weighting to Determine Land Protection Plan Priorities for Alternatives 2 and 3 and Alternative 4*.

Based on the revised 2010 LPP, there would be approximately 14 high-priority properties (totaling 102.55 acres), 72 medium-priority properties (237.44 acres), and 82 low-priority properties (77.48 acres). High priority properties could be exchanged or acquired with easements or covenants or could remain private. Therefore, implementation of this alternative could continue to result in long-term moderate to major adverse impacts to land use from continuing an unsustainable pattern of land use in the channel migration zone, particularly at McGregor Meadows because there would be fewer opportunities to exchange lands within this area.

As in Alternatives 2, 3 and 5, most land within Lake Chelan NRA would continue to remain in public ownership, with only about 24 acres, or 0.04 percent, offered for exchange (the same lands as in Alternatives 2 and 3). In Alternative 4 there would be more lands in the channel migration zone that could continue to be developed because of the different ranking criteria compared to Alternatives 2 and 3. In Alternative 4 as in other alternatives, however, there would be no cap on the number of acres that could be put under land protection status through NPS acquisition, exchange, easements, or covenants. Therefore the total acreage of public lands could increase slightly. As in Alternatives 2, 3 and 5, given the history of land acquisition and exchange in Stehekin over the past 16 years and because the major period of land acquisition for the Lake Chelan NRA has passed, most of the remaining 417 acres of privately owned land in Stehekin would remain private, a long-term minor to moderate adverse effect on land use, coupled with a minor long term benefit on land use from protecting up to 24 additional acres of private land. The changes that may occur as a result of the LPP are limited, compared to the major land use changes that occurred during the primary period of land acquisition for Lake Chelan NRA, when about 1,300 acres of private land were acquired.

## *Additional Impacts from Alternative 5*

Actions and impacts would be the same as in Alternative 2 for the road reroute. There would be no additional impacts on land use from the four grade control structures because these would be constructed within disturbed areas of roadway or driveways.

### Reroute Access Connector

In addition to the McGregor Meadows Access Road, a 940 - 1,200 foot long access connector would be implemented. Approximately 1.0 - 1.2 additional acres would be impacted altogether, a long-term minor adverse effect.

### Land Protection Plan Modifications

The 2012 LPP has been revised from the 2010 version presented in the DEIS to include eight criteria (including a criterion for visual sensitivity) instead of nine criteria. Instead of protecting lands throughout the channel migration zone from development, these criteria would emphasize protection of lands within the most vulnerable areas in McGregor Meadows and at the river mouth as well as in debris flow hazard zones. This revision of the LPP would result in 31 high-priority properties (totaling 189.62 acres), 72 medium-priority properties (totaling 148.84 acres), and 65 low-priority properties (totaling 78.34 acres). As in other alternatives, high priority properties could be exchanged or acquired with easements or covenants or could remain private. As in Alternatives 2 - 4, most would likely remain private. This would allow these lands to be developed, a long-term minor to moderate adverse effect on land use. As in Alternatives 2 - 4, where additional private lands remained undeveloped or were protected by exchange, acquisition, easements, or covenants, or where exchanged lands were restored, there would be long-term beneficial effects on land use. In contrast to Alternative 2, however, there could be fewer long-term beneficial effects.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate depending on the alternative) to minimize impacts to land use would be as follows:

- Clearly identifying the construction limits to prevent expansion of construction operations into undisturbed areas.
- Work with Chelan County on zoning and land use planning.
- Minimizing disturbance from reroutes by incorporating toe walls at fill locations where feasible.
- Retaining some sensitive lands previously proposed for exchange.
- Combining maintenance functions in buildings where possible.
- Restoring the former maintenance and housing areas.
- Limiting circulation space associated with new housing and maintenance areas to functional needs.
- Minimizing clearing of vegetation associated with the road rehabilitation.
- Continuing to exchange or acquire private lands in the floodplain and/or channel migration zone as identified by LPP priorities.
- Restoring some riparian areas to natural conditions.
- Continuing to use CCRs on exchanged public lands when private development is proposed.

## Cumulative Impacts

For a list of past, present, and reasonably foreseeable future actions considered in this analysis, see Appendix 5: *Cumulative Impacts Project List*. Over time in the lower Stehekin Valley, there

**Table IV-2: Changes to Land Use from Road Improvements**

| Alternative | Length of Rehabilitation* | Major Reroute Construction | Estimated Acres of Impact** for Road | Actual Area of Stehekin Valley Road | Restoration |
|---|---|---|---|---|---|
| Alternative 1 | 4.9 miles | n/a | 9.8 | 9.5 acres rehabilitation<br>0 new | 5.1 acres |
| Alternative 2 | 3.1 miles | 1.8 miles | 19<br>(13.0 reroute; 6.2 road rehabilitation) | 9.5 acres<br>3.4 acres new | 9.0 acres |
| Alternative 3 | 3.3 miles | 1.6 miles | 20<br>(13.0 reroute; 6.6 road rehabilitation) | 9.5 acres<br>3.3 acres new | 8.2 acres |
| Alternative 4 | 4.9 miles | n/a | 9.8 | 9.5 acres rehabilitation<br>0 new | 7.8 acres |
| Alternative 5 (Preferred) | 3.1 miles | 1.8 miles plus Access Connector 0.17 miles | 20<br>13.0 reroute<br>1.0 connector<br>6.2 road rehabilitation | 9.5 acres<br>3.4 acres new | 9.0 acres |

**Rehabilitation includes improvements to surfacing, drainage, sight distance, etc. The widest road sections (16 feet) are used in estimating impacts. There would also be impacts on 9.2 miles from resurfacing that includes the section of road from the Landing to Harlequin Bridge (under all alternatives).*
***FHWA estimates two acres of disturbance per mile for rehabilitation.*

have been both actions that have increased the amount of undeveloped land (such as removal and restoration of existing developed roads and buildings) and actions that have decreased it (such as construction of new administrative and recreational facilities, road reroutes, buildings, and utilities, as well as development on private lands). A comparison of data from when Lake Chelan NRA was established in 1968 to current data shows an increase both in development and in the number of acres of federally owned land as well as in the density of developed areas.

Although private land acreage has decreased from approximately 1,700 acres in 1968 (at establishment of the Lake Chelan NRA) to approximately 417 acres now, most of the remaining private land is expected to remain in private ownership. The NPS has no intention of purchasing all the land within the Stehekin Valley. Private lands could be developed or redeveloped. The Stehekin Community and visitor facilities would likely continue to both grow and diminish over time as lands are developed and/or redeveloped.

Actions that have added to the cumulative impacts of development in Stehekin include all of the former bank modifications along the Stehekin River (affecting 6.5 percent of the riverbank), several reroutes of the Stehekin Valley Road, construction of new NPS houses, impacts of NPS administrative and recreational facilities, and existing private development. Current and future

**Table IV-3: Changes to Land Use from Land Protection Plan Revision**

| Alternative | Lands Available for Exchange | Criteria-based Process? | Number and Priority of Properties High | Medium | Low |
|---|---|---|---|---|---|
| Alternative 1 | Up to 37 acres | Yes (focused on removing development from 100-year floodplain) | 62 | 18 | 86 |
| Alternative 2 | Up to 24 acres | Yes (focused on removing development from Channel Migration Zone) | 66 | 98 | 4 |
| Alternative 3 | Same as Alternative 2 | Same as Alternative 2 | 66 | 98 | 4 |
| Alternative 4 | Same as Alternative 2 | Same as Alternative 2 (except also focused on retaining the Stehekin Valley Road Current Alignment) | 15 | 81 | 72 |
| Alternative 5 (Preferred) | Up to 29 acres | Yes (focused on removing development from most vulnerable areas within Channel Migration Zone) | 31 | 72 | 65 |

*See Tables II-3, II-7, II-8 and II-9 in Chapter II: Management Alternatives*

impacts would also come from Federal Energy Regulatory Commission (FERC) relicensing mitigation projects and future Lake Chelan NRA actions.

Future proposed bank modifications would likely be the greatest under Alternative 4 (see Table IV-13: *Cumulative Impacts of Stehekin River Shoreline Erosion Protection Measures*) due to the continued presence of more of the road within the channel migration zone. There would be less road within the channel migration zone under Alternative 3, and the least under Alternatives 2 and 5, because of the proposed major road reroutes in those alternatives that would limit the ability of the river to affect the Stehekin Valley Road. Alternative 1 currently has fewer identified impacts, but because it keeps the road in place, it would eventually require erosion protection measures similar to those in Alternative 4. To the extent that additional private lands were subdivided and/or developed, these would add to the overall adverse effects on land use in the lower Stehekin Valley. These impacts would essentially be undifferentiated among alternatives, although the number of acres that could be exchanged is greatest under Alternative 1 (37) and next greatest under Alternative 5 (29) and the same for Alternatives 2 - 4 (24). While this plan would remove NPS housing and maintenance facilities, and portions of the road in Alternatives 2 and 3 from the channel migration zone, most private development would likely remain, could increase, and could continue to contribute adverse effects.

The road reroute (Alternatives 2, 3 and 5), new residential and maintenance area clustering at the airstrip (Alternatives 1 - 4 and to some extent in Alternative 5), raising the grade of the road (Alternatives 1 and 4), clustering of development (Alternatives 2 - 5), and introduction of public use facilities at the Stehekin River mouth (Alternatives 2, 4 and 5) would contribute to both cumulative adverse and beneficial effects by increasing the amount of development on previously undeveloped land and by restoring land through the removal of buildings and roads and restoration of formerly developed areas.

Alternatives 1 and 4 would contribute the fewest changes in land use (cumulative effects) since they would result in the least amount of additional development (see below); however, they would continue to have the potential to have the greatest impact on sustainability of road access and land use in the channel migration zone. Cumulative adverse impacts from Alternatives 1 and 4 would be minor, with some slight beneficial effects. The road reroutes in Alternatives 2, 3 and 5 would contribute greater cumulative effects on development (minor to major adverse effects) from the relocation of the road from adjacent to the river to a currently forested area, and would have the fewest impacts on the movement of the river channel. Alternative 5 would add to adverse effects from the construction of the short (940 - 1,200 feet) Reroute Access Connector. Cumulative adverse effects in Alternatives 2, 3, and 5 would be moderate, with more beneficial effects than in Alternatives 1 and 4 from restoration of disturbed areas, including floodplains and wetlands.

## Conclusion

Replacement and relocation of the maintenance facility and housing would have long-term localized moderate adverse effects on approximately five to eight acres of disturbed and adjacent land near the airstrip in Alternatives 2 - 4. Although these impacts could extend to other locations in the lower valley in Alternative 5, they would likely affect the same amount of land. Concurrent moderate to major beneficial effects on the 5 acres now occupied by the existing maintenance area would result from restoration of riparian and upland areas and from creation of more sustainable land-use patterns for Lake Chelan NRA facilities out of the channel migration zone.

While Alternatives 1 and 4 would affect new areas for the winter turnaround and pullouts and have continuing moderate to major adverse effects from retaining and raising the road through McGregor Meadows, Alternatives 2, 3 and 5 would also affect more than 3 acres of new area for the rerouted roadway. Alternatives 2, 3 and 5 would restore abandoned sections, but could affect an additional surrounding area for cuts and fills within an overall disturbance area of up to 23 acres. Alternative 5 would also have additional effects on 1.0 - 1.2 acres for the Reroute Access Connector. Combined, new development of currently undeveloped lands (road, maintenance facilities and housing area, erosion protection measures, etc.) would affect approximately ten acres in Alternative 1, 23 acres in Alternative 2, 23 acres in Alternative 3, 11 acres in Alternative 4, and 24 acres in Alternative 5. These would include short- and long-term minor to major adverse effects, with more effects in Alternatives 2 and 3 from reroute construction and more effects in Alternative 5 from both reroute construction and Reroute Access Connector construction.

LPP implementation could convert up to 37 acres of existing public land to private land in Alternative 1, up to 24 acres in Alternatives 2 - 4, and up to 29 acres in Alternative 5. Although private lands acquired would compensate for some of these, an unknown number of acres would be added as public land because exchanges do not occur on an acre-for-acre basis. Depending on the extent of development of these lands, effects would be localized, minor to moderate or major, and long term, with fewer impacts in Alternatives 2 - 5 from fewer available lands. An unknown amount of private land could also be acquired as public land through acquisition over time from willing sellers / donations.

Erosion protection measures to maintain the road would vary in the alternatives and would have negligible to moderate localized adverse effects. Riparian restoration and bioengineering would have long-term minor to moderate beneficial effects on land use by slowing unnatural rates of erosion. Impacts from new recreational facilities would be similar among all alternatives (negligible to moderate).

The greatest direct effects on land use would occur in Alternatives 2, 3 and 5 because they would relocate the road (with its existing adverse effects on the channel migration zone) to higher ground and disturb new areas (approximately 13 acres in Alternatives 2 and 3 and 14 acres in Alternative 5). At the same time, relocating the road would have long-term beneficial impacts on the sustainability of the Stehekin Valley Road and from restoring formerly developed areas, including floodplains and wetlands. Because Alternatives 1 and 4 would retain the road in the channel migration zone there would be fewer impacts on undisturbed lands (10 and 11 acres, respectively); however, these alternatives would result in unsustainable land use and would continue to affect the channel migration zone by leaving more of the road within it. Compared to the area that would be retained and protected within the lower Stehekin Valley, depending on the alternative selected, new development would occur on a very small percentage of the land within Lake Chelan NRA.

Because nearly all of Lake Chelan NRA would be retained in public ownership, reroute impacts in Alternatives 2, 3 and 5 would occur in a common forest community type, and the Stehekin Community would continue to have private lands available, there would be no significant adverse effects on land use as a result of the implementation of Alternatives 1 - 5.

## 2. Air Quality Impacts

### Air Quality Methodology

Air quality analysis was based on both qualitative and quantitative assessment of typical air emissions from construction and operations activities. While localized emissions from the proposed project would contribute to effects on air quality, deterioration of air quality is also a regional issue influenced by a variety of factors, including weather, transportation, manufacturing, and other criteria occurring outside Lake Chelan NRA.

**Context of Impact:** Air quality impacts were considered within the lower Stehekin Valley in the nonwilderness portion of Lake Chelan NRA and within the region.

**Type of Impact:** Beneficial air quality impacts would reduce pollutant emissions or lower pollutant concentrations, while adverse impacts would increase them.

**Intensity of Impact:**

- **Negligible:** Measurable or anticipated degree of change would not be detectable or would be only slightly detectable. Localized or at the lowest level of detection.
- **Minor:** Measurable or anticipated degree of change would have a slight effect, causing a slightly noticeable change compared to existing conditions. Often localized.
- **Moderate:** Measurable or anticipated degree of change is readily apparent, appreciable, and would be noticed by most people. Can be localized or widespread.
- **Major:** Measurable or anticipated degree of change would be substantial, causing a highly noticeable change compared to existing conditions. Often widespread.

## Air Quality Impacts

The North Cascades NPS Complex, including Lake Chelan NRA, is located in an attainment area for all ambient air quality standards. Air quality within the area is very good, but is locally affected by automobile and ferry emissions, the diesel generator at the power plant, dust from the unsurfaced roads and lake bed, home heating and maintenance by residents, NPS administrative operations, wildland fires and prescribed fires, and weather conditions, such as temperature inversions.

Although effects from the proposed actions under the alternatives would not cause either local or regional nonattainment of air quality or major changes in the emissions of criteria pollutants, it is likely that there would be localized short-term degradation of air quality within portions of the proposed project area and long-term beneficial effects in local conditions from elimination of dust on the new portion of road that would be surfaced with an asphalt chip-seal rather than gravel.

In general, air quality effects from the actions proposed in the alternatives would be generated by the following:

- Earth movement (including blasting, clearing and construction/demolition activities, and vegetation clearing and restoration)
- Exhaust emissions from transportation-associated vehicle emissions and nonroad (construction / demolition / forest clearing) equipment
- Evaporative emissions from the use of construction materials, such as the use of even low-volatile organic compound (VOC) solvents and paints during construction.

### *Impacts from Actions Common to All Alternatives (1 - 5)*

#### Maintenance Facility and Housing Replacement and Relocation

Replacement and relocation of the maintenance complex and housing area would require excavation associated with the placement of utility (water, power, and sewer) lines and for constructing circulation space (including parking and walkways). These activities would constitute localized negligible to minor short-term adverse impacts on air quality from particulates released during soil-moving activities, since soils at the site have a coarse texture.

Transport of construction materials sufficient to build the maintenance complex and housing structures would be needed. These supplies would require numerous barge trips from Chelan to Stehekin, using approximately 200 gallons of diesel fuel per trip (see Table IV-4: *Transportation of Materials*). Barges can transport up to 230 tons per trip and would thus transport needed materials in about 20 trips. This would require burning approximately 58 gallons of diesel fuel per barge load. As a result, there would be short-term minor to moderate localized impacts to air quality that would dissipate quickly as the barge passes uplake and downlake. Once in Stehekin, additional vehicle trips in 12- 18-cubic-yard dump trucks would be required to transport the materials upvalley to the airstrip area. Along the unsurfaced sections of road (for example, the unpaved road above Harlequin Bridge), trucks would produce dust that could affect nearby residents and visitors and degrade localized air quality with large particulates.

**Table IV-4: Transportation of Materials**

| Action | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 (Preferred) |
|---|---|---|---|---|---|
| Maintenance / housing | Unknown number of trips by barge and truck to transport materials and supplies to construct housing area | | | | |
| Road grade raise (Alternatives 1, 4) or reroute (Alternatives 2, 3 and 5) | 5,600 cubic yards fill imported | 30,000 cubic yards cut and 25,000 cubic yards fill within project area | 30.000 cubic yards cut and 23,000 cubic yards fill within project area | 5,600 cubic yards fill imported | 30,200 cubic yards cut and 27,000 cubic yards fill within project area |
| Road Surfacing | 9,300 cy base 1,700 cy surface | 8,800 cy base 1,675 cy surface | 8,800 cy base 1,700 cy surface | Same as Alternative 1 | 9,300 cy base 1,700 cy surface |
| Truck Trips from Barge | 500 | 950 | 900 | 1,000 | 550 |
| Wilson Creek | 1,100 cubic yards produced 8 - 10 logs | Fill imported or moved for slight grade raise. | Same as Alternative 2 | Same as Alternative 2 | Same as Alternative 2 |
| Milepost 8.5 grade raise for box culvert | N/A | N/A | N/A | N/A | 1,500 cubic yards fill needed |
| Rock for Barbs | 0 | 600 - 800 cubic yards | 400 cubic yards | 1,600 - 1,700 cubic yards | Same as Alternative 2 |
| Logjams | 0 | 100 logs | 1,000 logs | 200 logs | Same as Alternative 2 |
| Grade Control Structures | 0 | 0 | 0 | 0 | 600 cubic yards |

*Haul amounts are based on 75 percent design and could change.*

There would be evaporative emissions from the use of sealants and chemicals used in the project as well as from paints and solvents used in construction of the maintenance complex and new and replacement housing. To the extent possible, chemicals used in construction of the housing and maintenance areas would be low VOC emitters.

The carbon footprint of various activities is estimated by alternative in Table IV-5. Although Alternative 1 would produce less carbon emissions than all but Alternative 3, over time it is likely that its footprint would meet or surpass the other alternatives because new construction would be necessary to keep the Stehekin Valley Road in place.

Construction of the new maintenance complex and housing would also result in long-term minor to moderate beneficial effects on air quality by replacing numerous inefficient, poorly constructed buildings with buildings that have state-of-the art energy efficient design and construction, utilities, and appliances. Among the features that would be incorporated into the new buildings

**Table IV-5: Estimated Carbon Emissions by Action for Alternatives 1 - 5**

| Action | Alternative 1 (tons of carbon) | Alternative 2 (tons of carbon) | Alternative 3 (tons of carbon) | Alternative 4 (tons of carbon) | Alternative 5 (Preferred) |
|---|---|---|---|---|---|
| Road Rehabilitation and/or Reroutes | 150 | 100 | 90 | Same as Alternative 1 | 150 |
| Erosion Protection Measures | 74 | 100 | 112 | 138 | Same as Alternative 2 |
| Maintenance, Housing and Helipad | 45 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 |
| Recreational Improvements | Negligible | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 |
| TOTAL | 269 | 245 | 247 | 333 | 295 |

*Source: Appendix 19: Carbon Emissions Estimates and Calculations.*
*Note: This analysis does not include carbon associated with vegetation loss or gain or associated with hauling from one area to another on the reroute under Alternatives 2, 3, or 5. This would be determined by the contractor's work plan.*

would be solar panels; full insulation, including roof, walls, and crawl spaces; propane, rather than electric or wood, heat; double-glazed windows; low-flow water devices; water-efficient toilets; propane hook-ups for clothes dryers; insulated water pipes; compact fluorescent or LED lighting; and insulated water heaters.

### Road Rehabilitation

Ongoing maintenance and repair of the road surface and associated structures (including rock and vegetation removal, minor culvert work, crack sealing, chipsealing, and future asphalt overlays) would continue to result in construction exhaust and evaporative emissions associated with the use of vehicles and equipment.

A variety of heavy equipment, including dump trucks, graders, rollers, excavators, backhoes, and other devices, would be used to rehabilitate and surface the road from Harlequin Bridge to the winter turnaround under all alternatives. Use of this equipment would be concentrated along this portion of the Stehekin Valley Road, but would also travel from the Landing to beyond the turnaround at Milepost 9.2.

The most intensive concentration of heavy equipment use would be where new pullouts needed to be constructed, where fill material needed to be imported to raise the grade of shoulder areas prior to surfacing, and in those portions of McGregor Meadows where the road grade would be raised (Alternatives 1 and 4) or where reroutes would be constructed (Alternatives 2, 3 and 5). Other areas of concentrated impacts would include slight changes in the road alignment through McGregor Meadows to improve sight distance (Alternatives 1 and 4) and actions to reduce the slope at Milepost 8.0 (Alternatives 2 - 5). There would also be excavation where culvert work was needed, areas of side ditch construction or reconstruction, and fill areas associated with Wilson Creek for barb/bioengineering construction and for restoration. The work at Wilson Creek would also include construction of an access road to reach the edge of the river so that erosion protection measures can be constructed. This would result in some additional disturbance of soils.

Although the length of the rehabilitation would vary among alternatives, actions and impacts would be similar, encompassing 4.9 miles of road in Alternatives 1 and 4, 3.0 miles (1.3 miles before the reroute and 1.7 miles after) in Alternatives 2 and 5, 3.2 miles of road (1.3 miles before and 1.9 miles after) in Alternative 3). Compared to Alternative 1 Alternatives 2, 3 and 5 would have fewer rehabilitation actions and more new construction for the reroute sections. Alternative 5 would also have an additional 0.2 miles of disturbance for the Reroute Access Connector.

Localized degradation of air quality would occur in the vicinity of earth-moving construction activities, including excavation, filling and grading, brush removal, blasting, and the use of heavy equipment, as well as from vehicles passing over temporarily or permanently unsurfaced road surfaces, causing dust to rise. Forest-clearing equipment (chainsaws) and other hand and power tools would also be used in the road rehabilitation and to clear areas where new pullouts and the winter turnaround would occur (all alternatives) and for the reroutes (Alternatives 2, 3 and 5), causing negligible to minor exhaust emissions over a period of several days to several months.

There would be also be increased (locally negligible to moderate) gasoline and diesel emissions during rehabilitation of the road from the use of construction vehicles and equipment, particularly when actions resulted in temporary traffic delays and increased idling of vehicles, causing minor, localized emissions in the vicinity of the delay (due to the small number of public vehicles in Stehekin). Although traffic delays would temporarily increase the concentration of pollutants in the vicinity of idling vehicles, depending on air movement associated with weather conditions, these emissions would be short term, localized, and quickly dispersed and could be reduced through possible idling limitations during delays.

Negligible to minor localized adverse effects on air quality would occur from dust emissions, depending on the season, type of vegetation, fuel, and soil moisture levels, which (similar to other actions below) would be minimized by the use of best management practices (BMPs) such as use of a water truck during construction and covering soils during long-distance transport.

**Surfacing:** Surfacing the road (with asphalt chipseal) would involve importing materials and excavating, replacing, and/or compacting the road base and subbase, where necessary. This would result in minor short-term adverse effects from earth movement and transportation of materials. Localized long-term moderate beneficial impacts on air quality would occur from a decrease in the release of dust from driving over formerly unsurfaced roadways. Surfacing would occur on 3.9 miles in Alternative 1. Under Alternatives 2 and 3, surfacing would include the new reroutes but not the McGregor Meadows Access Road. Similarly, under Alternative 5, the reroute would be surfaced, but not the McGregor Meadows Access Road or the Reroute Access Connector. Therefore, 4.9 miles would be newly surfaced in Alternatives 2 - 4. In addition, there would be a new asphalt chipseal surface from the Landing to Harlequin Bridge. Adverse effects on air quality, including dust from driving on unsurfaced roads and particulate releases from the movement of fill materials, would occur from the need to import and / or place approximately 11,000 cubic yards for surfacing and base material in Alternatives 1, 4 and 5; 10,475 cubic yards in Alternative 2; and 10,500 cubic yards in Alternative 3. Depending on whether this material was entirely imported or gathered from unused material from the Company Creek Pit, impacts associated with transport would vary but would likely have a short-term moderate adverse impact because of the number of truck loads required to transport it (approximately 110).

### Restoration and Bioengineering

All alternatives would also include long-term negligible to minor adverse impacts from restoration of abandoned sections of road, from riparian restoration in some areas, from additional plantings, and short-term negligible adverse impacts from transportation of plant materials and supplies. Restoration would be greatest under Alternatives 2 and 5, followed by Alternatives 3, 4, and 1.

## *Additional Impacts from Alternative 1*

### Road Grade Raise

Approximately 5,600 cubic yards of material would be imported and placed for the grade raise through portions of McGregor Meadows. Excavating and moving material for the road grade raise from a location outside of Stehekin would result in minor to moderate localized adverse impacts to air quality from transport and placement of these materials. Between 300 and 500 dump truck loads (12 - 18 cubic yards each) would be required to transport the material from the Landing to McGregor Meadows, and approximately 62 barge loads would also be required. Over time, it is likely that this fill material would need to be replaced periodically following flooding, resulting in ongoing (long-term) minor localized adverse effects.

There would be no increase in roadway capacity or increased overall traffic volumes as a result of the road improvements. As a result, long-term exhaust emissions from vehicles using the Stehekin Valley Road are not anticipated to change. Although public transportation (buses) on the Stehekin Valley Road would not be affected by the proposed rehabilitation of the road, rehabilitation would increase the ability of buses and other large vehicles to stay on the road with additional surfacing and pullouts and an enlarged winter turnaround, perhaps having a negligible beneficial effect on decreasing particulate emissions.

Photo 29 – Lower Stehekin River Valley in 1921 before the water level of Lake Chelan was raised (Note historic Field Hotel near left-center of the image).

### Erosion Protection Measures

Actions to locate rip-rap and log-cribbing at Wilson Creek would require additional transport of large rock and logs and excavation of the bank, contributing additional localized minor adverse effects on air quality.

### Recreational Facilities

**Lower Valley Trail:** Construction of the Lower Valley Trail in Alternatives 1 and 4 would require removing vegetation and excavating to mineral soil approximately 6.3 miles of new trail in an area comprising about 1.58 acres. Since most of this work would be done with hand tools and not large machinery, effects on air quality would be localized and negligible to minor.

## *Additional Impacts from Alternatives 2 and / or 5*

### Road Reroute

Compared to the impacts of raising the grade through McGregor Meadows in Alternative 1, earthmoving associated with the 1.8-mile reroute would take longer, resulting in more potential impacts to air quality from the release of particulates (dust) and emissions from construction equipment and vehicle traffic. The 30,000 cubic yards of soil and rock would be both excavated and moved within the reroute area. Fill would be approximately 25,000 cubic yards. Cut and fill needs have been designed to be approximately balanced (cut areas used for fill areas). In Alternative 5, the cut would increase slightly to 30,200 cubic yards and fill would also increase to 27,000 cubic yards.

Alternatives 2 and 5 would also result in more forest clearing than Alternative 1, with minor localized adverse impacts from equipment use. Combining the 13 acres of impact for the road reroute and the area associated with other new disturbance, the total disturbance area could be up to 23 acres, which would have air quality impacts during removal of trees and other vegetation and from particulates disturbed by the equipment used for removal. Alternative 5 would also impact 1.0 - 1.2 acres for the Reroute Access Connector for a total of up to 24 acres.

These alternatives also differ from Alternative 1 because there would be additional vehicle (including diesel truck) travel related to constructing and surfacing an additional 1.8 miles of new Stehekin Valley Road reroute. Although there would be no increase in roadway capacity or increased overall traffic volumes as a result of the road improvements, because the road through McGregor Meadows would dead-end, there would be some additional trips to travel back through McGregor Meadows after reaching the end to continue on the Stehekin Valley Road for some residents, delivery services, and/or utility vehicles. This would result in a negligible to minor increase in vehicle trips per day and consequent additional negligible adverse effects on air quality.

### Recreational Facilities

**Lower Valley Trail:** In Alternatives 2, 3 and 5, impacts from constructing the Lower Valley Trail would be similar, except that in these alternatives, more existing trail or former roadway (7.9 miles) would be used and fewer miles of new trail (4.6) would be constructed, resulting in fewer new adverse impacts than in Alternatives 1 and 4.

**Campgrounds and River Access Point:** Localized negligible adverse effects on air quality from ground disturbance releasing particulates would also occur during construction of new campsites at Purple Point Horse Camp and Rainbow Falls, relocation of Bullion Camp, and construction of the new river access and associated parking area.

#### Erosion Protection Measures

Approximately six to eight barbs would be constructed in Alternatives 2 and 5 near the mouth of the Stehekin River, Wilson Creek, and at Frog Island, and two logjams (one on the bank at Boulder Creek, one near the mouth of the river). Because each barb would require up to 100 cubic yards of large rock, there would be transport by barge and truck of approximately 600 - 800 cubic yards of rock. Approximately another 130 cubic yards would be used for an avulsion sill at Boulder Creek. Each barb would require six to nine trips to transport rock from Stehekin Landing. In addition, under Alternative 5, there could be transport of rock for four grade control structures -- approximately 600 cubic yards, requiring 60 additional trips from Stehekin Landing. In addition, under both Alternatives 2 and 5, there would be transport and placement associated with procurement of approximately 50 large logs each for the river mouth and Boulder Creek logjams. These would be gathered as floating logs from the head of Lake Chelan, from the tops of logjams below Boulder Creek, or from the reroute.

### *Additional Impacts from Alternative 3*

#### Road Reroute

As in Alternative 2, compared to the impacts of raising the road grade in Alternative 1, earthmoving associated with the 1.6-mile reroute would take longer, resulting in short-term localized adverse impacts to air quality from the release of particulates (dust) and from construction equipment and vehicle traffic. Because cut and fill amounts would be approximately balanced for the reroute, there would be no additional importation of fill material to Stehekin for that portion of the project; rather, this material (approximately 30,000 cubic yards of cut and 23,000 cubic yards of fill) would be transported within the area of the reroute. As in Alternatives 2 and 5, there would be additional vehicle travel related to constructing and surfacing an additional 1.6 miles of new Stehekin Valley Road along the reroute, slightly less than in Alternative 2.

#### Erosion Protection Measures

Effects from building logjams at Weaver Point, at Stehekin River mouth, near Boulder Creek (along with a grade-control structure / avulsion sill), at Wilson Creek, and at Frog Island, as well as two barbs at Weaver Point and two at the Lower Field, would be short and long term, localized, and minor to moderate. These barbs would require up to 400 cubic yards of imported rock and more trips for transport from Stehekin Landing, a short-term minor adverse effect. Procurement of logs for the logjams at Boulder Creek would be the same as in Alternative 2, plus additional logs would be procured for Weaver Point (150), Frog Island (200), Wilson Creek (300), and near the Stehekin River mouth (300). As in Alternatives 2 and 5, these would be gathered from floating logs or from the tops of logjams below Boulder Creek.

#### Recreational Facilities

**Lower Valley Trail:** Actions and impacts would be the same as in Alternatives 2 and 5.

**Campgrounds:** Additional negligible adverse effects would occur from construction of an additional camp near Company Creek.

### *Additional Impacts from Alternative 4*

#### Road Grade Raise

Actions and impacts would be the same as in Alternative 1.

#### Erosion Protection Measures

Because 16 - 17 barbs would be placed at eroding bank areas, 1,600 - 1,700 cubic yards of rock would be transported for barbs, a short-term moderate adverse effect. In addition, there would be transport for logs for the small logjam and avulsion sill located near Boulder Creek (50 logs), transport associated with Wilson Creek, the small logjam near the river mouth (50 logs), and the logjam at Weaver Point (150 logs), which would contribute additional short-term minor to moderate localized adverse effects.

#### Recreational Facilities

**Lower Valley Trail:** Actions and impacts would be the same as Alternative 1.

**Camps and River Access Point:** Actions and impacts would be the same as described in Alternatives 2 and 5 plus the Company Creek campground from Alternative 3, with minor short-term adverse impacts during construction.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to air quality would be as follows:

- Chipping or mulching vegetation on site rather than disposing of it off site or burning it.
- Spraying water to minimize fugitive dust resulting from roadway construction.
- Covering trucks transporting soils and aggregate to Lake Chelan barge.
- Encouraging contractor employees and NPS employees to travel in groups to and from the project site (rather than in multiple separate vehicles).
- Revegetating bare and staging areas as soon as possible (upon final grading or when staging area is no longer in use).
- Minimizing the extent of vegetation removal associated with road rehabilitation.
- Encouraging the use of local labor sources and large-volume material delivery to minimize trip generation during construction activity.
- Not locating wood-burning stoves or fireplaces in buildings.
- Using propane and solar devices for heating.

- Using low-VOC paints, solvents, and other chemicals in building construction.
- Encouraging idling of construction vehicles and equipment for no longer than 15 minutes when not in use.
- Encouraging use of a biodiesel mix fuel rather than traditional diesel fuel.

## Cumulative Impacts

Over time, in the region, human impacts such as the development of roads, businesses, including industry, and housing have contributed to increasing vehicle travel to obtain goods and services and to access recreational experiences. In Washington, as elsewhere, population increases have resulted in dramatic increases in the number of vehicle miles traveled. In Stehekin, because the road network is isolated from others in Washington, miles traveled have not increased as much.

Increases associated with vehicle travel in the region have also been coupled with increases in the number of industrial, commercial, and other vehicle sources of pollution. With the passage of the federal and state clean air acts, emissions controls have been implemented on stationary and mobile sources of air quality degradation. Washington has been proactive in establishing vehicle emissions standards for urban areas. Over time, these standards have changed and have resulted in moderating the effect of ever-increasing population and industry.

In Lake Chelan NRA, existing long-term adverse impacts to air quality (vehicle traffic, lakebed dust, campfires, and power generation) would not increase as a result of the proposed actions under the alternatives described in this plan. There would also be no changes to existing long-term regional beneficial effects on air quality, such as carpooling and public transportation to and within the Stehekin Valley. Therefore, when added to the impacts of other actions that may occur in Lake Chelan NRA and which would affect air quality, including other construction, transportation, and restoration projects, the proposed action, under Alternatives 1 - 5, would contribute negligible to minor localized short-term adverse effects. Additional short-term adverse effects would be contributed by the superfund clean-up of the Holden copper mine site. If barge traffic for the road and clean-up projects occurred simultaneously, there could be localized degradation of air quality. A cumulative minor to moderate localized beneficial impact would also be contributed under all alternatives from the reduction in gravel use from the Company Creek Pit and from reduced dust on the main valley road (from surfacing). Future cumulative beneficial effects would also occur from reduced emissions in the maintenance area based on reduced energy use associated with more efficient buildings and heating and cooling systems in modern structures. If the project occurred at the same time as other projects having an effect on air quality, such as during other state transportation projects, effects would increase, but would remain localized and negligible to minor and would be generally undetectable, except within the vicinity of the actions. Because there are no new long-term effects that would add to emissions, there would be no cumulative adverse effects on regional air quality from proposed actions under the alternatives described in this plan.

## Conclusion

Actions in the alternatives would result in a variety of short-term particulate emissions (such as dust) during excavation, filling, and grading. Exhaust emissions would be produced from vehicle travel, transport of fill materials both to and within the project area, and ongoing operations during use (heating of buildings, etc.). Evaporative emissions would come from surfacing, painting, and solvent use, primarily during construction, but also later during operation of the maintenance area. These short-term operations impacts would range from negligible to minor.

Overall, the effects of clearing vegetation, excavating soil, and placing fill would contribute to short-term moderate increases in particulate concentrations, occurring only during construction activities. These impacts would be locally negligible to minor for recreational facilities; minor for erosion protection measures (Alternatives 1 - 5); minor to moderate for Milepost 8.0 actions (Alternatives 2 - 5); minor to moderate for construction of the maintenance and housing areas (Alternatives 1 - 5); negligible to moderate for road rehabilitation actions (Alternatives 1 - 5); minor to moderate for reroute construction soil transport and movement (Alternatives 2, 3 and 5); and moderate for grade raise soil transport and movement (Alternatives 1 and 4). There would be no long-term or cumulative contributions that would increase particulate concentrations from the implementation of Alternatives 1 - 5; however, long-term moderate beneficial impacts on air quality would occur from eliminating dust from unsurfaced sections of road as a result of increased road surfacing and from reconstruction of the maintenance area. Beneficial impacts associated with the roadway would be greatest in Alternatives 2, 3 and 5, where the road and reroutes would be surfaced with an asphalt chipseal (except for the McGregor Meadows Access Road in Alternatives 2 and 3 and the Access Connector in Alternative 5), and least under Alternatives 1 and 4, because the unstable area through McGregor Meadows would not be surfaced.

All alternatives would increase the need for barge transport due to the construction of the maintenance and housing areas and for the importation of surfacing materials. Long-term exhaust emissions under all alternatives would result from ongoing vehicle travel in Stehekin and would be similar to Alternative 1, since overall vehicle use would not rise as a result of the implementation of the action alternatives (Alternatives 2 - 5). Short-term effects, however, would vary among the alternatives and would be associated with rehabilitation and grade raises (Alternatives 1 and 4) or rehabilitation and construction of reroutes (Alternatives 2, 3 and 5) as well as surfacing of the road in all alternatives. Minor road realignments, the construction of varying numbers of barbs under each alternative, and the construction of recreational features (Lower Valley Trail, campsites, and the river access point) would also vary by alternative and would contribute to short-term minor air quality effects from diesel exhaust during construction. Road improvements would take from 1 to 3 years to implement, while other portions of the project would take place over a period of approximately 3 to 15 years as other portions of the alternatives (erosion protection measures, recreational improvements, and housing and maintenance facility construction) were funded and implemented. As a result, emissions would occur in a number of areas, often widely spaced in time and distance from each other. Most of these impacts would be associated with impacts from carbon monoxide and particulates associated with diesel exhaust. Where biodiesel was used, these impacts would be fewer.

Vehicle and evaporative emissions and dust would be largely dispersed by air movement in the project area, although lingering effects from vehicle and barge emissions would occur during traffic delays and some temperature inversions. Airborne particulates would be more likely to increase in concentration on dry, windless days. Overall impacts from dust and construction equipment emissions would be short term and negligible to moderate along the project corridor under Alternatives 2, 3 and 5, primarily due to road construction, and negligible to minor under Alternatives 1 and 4, primarily due to road rehabilitation. Effects would be the same under all alternatives for construction of the maintenance and housing areas, and similar effects would occur in Alternatives 2 - 5, from construction of recreational facilities, since the primary differences would be one more camp in Alternatives 3 and 4 and no river access point in

Alternative 3. Alternative 1, with construction of only the Lower Valley Trail, would likely have fewer impacts related to recreational features.

Overall, the action alternatives would result in negligible to moderate degradation of local air quality, but these effects would be temporary, lasting only during construction activities. Surfacing the road would reduce the level of dust currently generated by vehicle travel over the unsurfaced road, thus eliminating fugitive dust emissions over time. Dust reduction would be one of the primary achievements of the road project and would produce moderate long-term beneficial effects on air quality, helping to preserve and improve the status of the local airshed (NPS LACH 2005a). Other beneficial long-term impacts would be realized by reducing the number of dump trucks and grader trips needed to maintain the gravel road in the flood-prone McGregor Meadows section of the Stehekin Valley Road. Energy-conservation measures employed in the housing and maintenance area structures would also achieve long-term air quality benefits by reducing emissions, primarily those associated with heating, and by constructing efficient heat-retaining structures. Restoration and bioengineering would also contribute some negligible beneficial effects from plant establishment.

There would be no major adverse impacts on air quality or air quality-related values from the proposed actions under the alternatives described in this plan. The area would continue to be within an attainment zone for NAAQS and long-term or cumulative impacts to air quality relative values would not occur.

# 3. Soils and Vegetation Impacts

(These impact topics are considered together because many of the same actions that would affect soils would also affect vegetation.)

## Soils and Vegetation Methodology

### *Soils*

Soils analysis was based on a qualitative assessment of generalized soil types and typical effects of the type of impact described. Quantitative analysis was also conducted to determine the amount of soil to be removed in major excavation and fill areas.

**Type of Impact:** Activities that result in soil impacts include the construction of buildings or structures, parking areas, roads, trails, and other facilities. Adverse impacts to soil include soil removal, profile mixing, compaction, erosion, and contamination. Adverse impacts would degrade chemical or physical properties of soils or result in the loss or temporary removal of soils. Beneficial impacts result from actions that protect soils from erosion or restore natural soil conditions. Restoration and revegetation have both adverse and beneficial effects.

- **Soil Removal:** Surfacing and construction remove and/or cover the soil surface, resulting in changes to basic soil properties, including altering the ability of water to penetrate the soil, nutrient availability, and water-holding capacity. Excavation and removal of the soil surface would result in a long-term impact because basic soil properties (such as compaction, texture, and physical and chemical composition), which may have taken tens to hundreds or thousands of years to develop are removed. Covering the surface reduces water movement and minimizes the opportunity for the normal physical and chemical soil processes.

- **Soil Profile Mixing:** Soil excavation and redistribution causes removal or mixing of the soil profile and disrupts soil structural characteristics, interrupting the chemical, physical, and biological processes that naturally occur in soil horizons. The level of change is dependent on the level of the alteration. It may take centuries to redevelop the soil profile.

- **Soil Compaction:** Soil compaction may occur as a result of construction activities or in areas of intensive use such as trails, campgrounds, and picnic areas. Finer-grained soils, including wetland and silty-sandy river soils, are very susceptible to compaction effects. Soil compaction reduces infiltration rates and decreases pore space, thereby increasing surface runoff and the potential for erosion. Deep compaction of soils may impede subsurface water movement. In turn, these effects can alter soil chemical processes such as nutrient transfer, biological processes such as root development and microbial patterns, and physical processes such as soil structure. Vegetation growth on compacted soils is often limited due to low infiltration, poor root penetration, and lack of nutrients.

- **Soil Erosion:** Removal of vegetation and organic-rich soil horizons through grading or casual pedestrian use may result in accelerated erosion of the soil surface, particularly on slopes steeper than 50 percent. Where vegetation is replaced by hard surfacing, such as buildings, surfacing, or walkways, soils are also compacted and physical and biotic processes are disrupted. Sandy soils on steep slopes and along watercourses are especially susceptible to erosion, especially poorly consolidated alluvial soils such as those found along the Stehekin River. In contrast, gravelly soils on alluvial fans and some river terraces are far less susceptible to erosion. *Rare or Sensitive Soils*: Certain microclimates in the lower Stehekin Valley have distinct vegetation cover and soils. Bare rock exposures host slow-developing, easily disturbed cryptogrammic soils. Wetlands and other areas with fine-grained soils are prone to erosion and compaction impacts.

- **Soil Contamination:** The addition of chemical constituents into the soils as a result of surfacing and untreated runoff from surfaced surfaces, or from incidental spills, may alter micro- or macro-organism populations, diversity, and dynamics. Machinery involved with construction activities may deposit small amounts of natural and synthetic petroleum-hydrocarbons onto soils through equipment failure or normal operations.

- **Soil Restoration:** Ecological restoration that would minimize erosion potential and increase organic matter in the soil is considered a beneficial effect. Short-term adverse effects may occur during site-restoration activities where construction equipment may compact soils, temporarily eliminate groundcover vegetation, and cause potential erosion from surface water runoff over the exposed soils; however, over the long term, restoration will restore the soil-forming processes by reducing erosion.

**Intensity of Impact:**

- **Negligible:** The effects to soil resources would generally be undetectable. Any effects to soil productivity or fertility would be slight and no long-term effects to soils would occur.

- **Minor:** The effects to soils would be detectable and would include loss of organic surface horizons. Effects to soil productivity or fertility and the area affected would be small.

- **Moderate:** The effect on soils would be readily apparent and likely long term, and would potentially include loss of subsurface soil horizons. Impacts would result in a change to the character of the resources over a relatively wide area, or in changes to a rare or sensitive soil.

- **Major:** The effect on soils would be readily apparent and long term, and would cause soil erosion over large areas (or over small areas, if a particularly rare soil type is threatened).

### *Vegetation*

Vegetation analysis was based on a qualitative assessment of project area vegetation and the effects anticipated as a result of ongoing maintenance, construction, or rehabilitation. Quantitative analysis was also conducted to determine the effects of vegetation loss. This analysis was based on the amount of disturbance (removal of or damage to vegetation) from construction or road operations compared to current conditions. It is also considers the benefits of site restoration. Assessment of the potential for the project to introduce or spread nonnative plant species, such as exotics and noxious weeds, was also made.

The geographical extent of plant communities has been determined through field and aerial vegetation mapping. Field reconnaissance of areas of potential impact was used to analyze plant community types and to look for any state and federally-listed sensitive, rare, threatened, or endangered species. Human use can decrease or alter native vegetation cover, disturb or compact soils and create conditions favorable for nonnative species or the introduction of nonnative species. Because human use impacts such as recreational use and foot traffic can extend beyond developed areas and affect plant community size and continuity, the potential for these indirect impacts beyond development boundaries was considered as a factor in determining the intensity of impacts on vegetation.

The evaluation of the integrity of plant communities was based on:

- **Biodiversity** (includes diversity of communities within an ecosystem, species within a community, and genetic variation among individual species): Measures of biodiversity may include plant community structure and composition, connectivity of ecosystems, variation in age, structure (density and arrangement), individual species composition and abundance, and the presence or absence of natural structural layers.
- **Invasive Exotic species introduction and spread:** Invasive plants are aggressive nonnative species and pose an ecological threat to the community in which they are found. These invasive nonnative species can alter soil chemical and physical properties, hamper native species establishment, and alternative plant community structure and function. This impact analysis considered whether proposed actions would favor the establishment of nonnative species and the ability to contain and reverse nonnative plant infestation.
- **Resilience of the plant community:** Resilient plant communities are more capable of withstanding human impacts without long-term deformation because they can recover more quickly.

**Type of Impact:** Actions that reduce the size of or disrupt the continuity and/or integrity of native plant communities are considered adverse impacts. Ground disturbance and importing materials such as soils, gravel or nonnative plants can adversely impact native plant communities because they provide means for nonnative species to become established. Restoration of disturbed areas can be done using native seeds and plants. Native plants and soil can be salvaged prior to disturbance and used during restoration to hasten establishment of native communities. Mulch, or other stabilizing materials may accelerate site recovery and reduces opportunities for the establishment of exotic plants. Actions that preserve and/or restore these essential components of native plant communities constitute beneficial impacts. New development within an otherwise intact and undisturbed area may fragment or disassociate plant communities. Small areas of restoration surrounded by existing or new development may constitute a lesser beneficial impact on plant communities than restoration of a small area adjacent to a larger intact vegetation community. In general, reducing and limiting fragmentation and maintaining connections within and among plant communities can minimize adverse effects on plant and animal communities.

**Intensity of Impact:**

- **Negligible:** Impacts would have no measurable or perceptible changes in plant community size, continuity, or integrity. Individual native plants would be affected, but there would be no effect on native species populations. There would be no increases or barely detectable increases in the number of nonnative species and the extent of their range. The effects would be short term and localized but would not be measurable.
- **Minor:** Impacts would be measurable or perceptible and localized within a relatively small area, and the overall viability of the plant community would not be affected. Individual plants and/or a relatively minor segment of populations would be affected. Changes in the extent of nonnative species would be short term, localized, and measurable.
- **Moderate:** Impacts would cause a change in the plant community (e.g., size, continuity, and integrity); however, the impact would remain localized. The change would be measurable and perceptible, but could be reversed. The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population in the long term and over a relatively large area. Changes in the extent of several or more nonnative species would be over a relatively long period of time. Nonnative plants could spread beyond the localized area.
- **Major:** Impacts would be substantial, highly noticeable, and permanent in their effect on plant community size, diversity, continuity, or integrity. The alternative would have a considerable long-term effect on native plant populations and nonnative plants.

## Soils and Vegetation Impacts

Under all Alternatives (1 - 5), soils and vegetation would be affected at various sites along the Stehekin Valley Road and Company Creek Road, wherever excavation, fill, vegetation disturbance or removal, and/or covering areas with hard surfaces would occur. Soils and vegetation would also be affected in the proposed maintenance and housing areas, for erosion protection measures, and near the recreational facility improvements. Much of this disturbance would be limited to the existing road prism (in the area affected by original road construction activities) and/or other existing disturbed areas. Some actions, however, including those associated with the construction of the maintenance and housing areas, would occur in areas that either are recovering from former disturbance from human activities or have not been affected by recent human activities. Restoration of native riparian and upland plant communities which varies by alternative would benefit soils and vegetation.

Vegetation loss combined with construction, including compaction from grading for gravel, concrete, or asphalt surfacing, would also change soil water infiltration. During excavation and grading, soils would be mixed, moved, and replaced with fill, causing a long-term change in soil profiles, loss of vegetation, and decreasing soil productivity. Fine-grained soils would be more likely to be compacted by construction activities, which would temporarily decrease soil permeability, change the soil moisture content, and lessen water storage capacity.

### *Impacts from Actions Common to All Alternatives (1 - 5)*

#### Maintenance Facility and Housing Replacement and Relocation

There would be moderate adverse effects on soils and vegetation from development of about five to eight acres of existing disturbed area near the airstrip for the maintenance area and housing in Alternatives 1-4 and also including other previously disturbed locations in the lower valley in Alternative 5. These areas contain bigleaf maple and Douglas-fir; shrubs, including ceanothus, elderberry, and willows; and a variety of forbs and grasses. With the proposed clearing for the new maintenance and housing areas, there would continue to be localized, long-term moderate adverse effects on soils and vegetation. Construction would require excavation of relatively young, weakly developed soil profiles and would change infiltration through placement of impervious structures and surfaces, such as buildings, parking areas, roads, and paths. Compaction would occur from the placement of utility system infrastructure (water, sewer, and electric lines), and could result in limited soil and vegetation recovery following construction. Much of this area, however, is comprised of coarse-grained gravel soils not prone to compaction and has previously been disturbed. In addition to space occupied by buildings, accompanying circulation and parking areas for the housing and maintenance areas would also affect soils and vegetation. Approximately 0.3 acre of impermeable surfacing (including for buildings and circulation) would be added for the maintenance area. It is likely that a similar area would contain impermeable surfacing associated with placement of housing. Combined, the loss of vegetation, soil profiles, mixing of soil with fill, and loss of infiltration would have a localized long-term minor adverse effect, with impacts limited because of the poorly developed (young) coarse-grained soils and highly modified vegetation type (primarily comprised of nonnative species of grasses and forbs in open areas).

Restoration of the former maintenance area, comprising approximately 5 acres, would result in long-term major localized beneficial effects, from replacement of topsoil and vegetation, on riparian and upland vegetation and soils within this currently impacted floodplain. Soils in the existing maintenance area are finer-grained and more productive than those at the airstrip. Ongoing minor adverse effects would also continue to occur from maintaining the Company Creek Road near the former maintenance area.

#### Road Rehabilitation

Routine, ongoing maintenance of the road surface would involve shoulder, culvert, and ditch maintenance. Vegetation would continue to be removed and soils would be mixed and removed, causing localized displacement of poorly developed soils, a long-term negligible to minor adverse effect occurring at various locations over time. During flooding, soils in recently disturbed or vulnerable areas would also erode.

Road improvements would occur over 4.9 miles of road (Alternatives 1 and 4) and on existing road in Alternatives 2, 3 and 5, from Harlequin Bridge to the winter turnaround, and would affect approximately 9.5 acres of existing disturbed area. New soil and vegetation disturbance would occur from the addition of pullouts, the winter turnaround, and construction of new side ditches. There would be long-term minor to moderate adverse effects over much of this area, plus short-term impacts to accommodate construction limits. Overall construction limits are estimated (by FHWA) at two acres per mile for the 4.9 miles but would likely not affect areas much beyond the existing roadway except for improvements at Wilson Creek, Milepost 8.0, Milepost 9.2, pullouts, and the winter turnaround.

Road construction and improvements would include placement of fill materials on top of the soil profile and covering soil with impervious surface treatments, a long-term localized minor to moderate adverse effect. Surfacing would result in water running off rather than infiltrating, with potential resultant soil erosion from water concentrated off of impervious surfaces in ditches and culverts. Water runoff would also pick-up contaminants such as oil and gasoline residue and would enter the soil through adjacent unsurfaced shoulders and side ditches. The presence of these contaminants would have a localized but long-term minor adverse effect on vegetation and soils. Negligible to minor long-term beneficial effects would occur from retaining topsoil during construction of new areas, such as pullouts, and pulling it back along the edges of the road to allow for restoration by natural or broadcast seeding of native plants.

In addition to direct vegetation loss, other negligible to minor indirect effects on vegetation would include changes to the existing plant community. These would occur in areas where, over time, the addition or loss of direct sunlight changes the local plant community type or favors nonnative species inadvertently imported in fill. Vegetation adjacent to the newly surfaced road would receive a long-term minor to moderate localized beneficial effect from reduced dust.

### Erosion Protection Measures

**Milepost 5.3 (Wilson Creek):** Excavation at Wilson Creek to lay back the slope would affect 0.3 acre of upland soils and vegetation. In addition to the actual work required to stabilize the road, approximately 1.5 acres would be affected by the need to construct and maintain an access route for the work, a long-term localized moderate adverse effect. The slope rehabilitation action would generate 1,100 cubic yards of gravel, sand, and boulders, with 550 cubic yards reused on site. Among the trees that would be affected are Douglas-fir, western red cedar, and bigleaf maple in a variety of size classes. Approximately 12 trees and a snag (between 20 and 30 inches diameter at breast height [dbh]) would be among the vegetation removed. Other observed vegetation includes false Solomon's seal, wild rose, snowberry, dogwood, wild raspberry, and bracken fern. The slope is primarily comprised of rocky cobbles interspersed with trees, intermittent shrubs, and grasses. Several large cedars on the river side would be retained, as would a large cottonwood. Impacts from the vegetation removal would be long-term adverse and moderate. Short- and long-term beneficial impacts would occur from vegetation reestablishing at the site after construction.

**Weaver Point:** Soils and vegetation would be disturbed from relocation of 1 - 2 campsites affected by lakeshore and riverbank erosion.

### Large Woody Debris

There would be no impacts from the continued procurement of floating large woody debris from Lake Chelan after major floods under Alternative 1.

### Recreational Facilities

**Lower Valley Trail:** The Lower Valley Trail would be constructed from new and existing trail (and in Alternatives 2, 3 and 5 from sections of abandoned road). The trail would be constructed by pulling back the topsoil and associated vegetation to expose bare mineral soil. There would be little deep excavation, except where needed to place water-flow structures, such as culverts or water bars. Deep excavation could also be necessary to construct the footings for the bridge crossing to the Stehekin River Trail if existing concrete bridge supports were not used. Because the equipment used would be mostly hand tools rather than heavy equipment, effects on soils would be minor. Over time, plants (some of which would likely be nonnative) would reestablish at the edges of the trail and plant debris would fall on the trail tread and would both soften the appearance of the trail and contribute to reestablishment of the surface horizon. Depending on the amount of trail use and soil type, compaction may take place over many years. No hard surfacing would be applied; therefore water would continue to infiltrate both the pathway and adjacent areas in most locations. Overall, effects on soils and vegetation in a variety of plant communities from construction of the Lower Valley Trail would be localized, but because they would combine to affect more than an acre of land in all alternatives, impacts would be adverse, minor to moderate, and long term. More impacts would occur from some aspects of trail construction, including where the trail is constructed across steep slopes and drainages and near Little Boulder Creek.

Adverse effects from construction would be coupled with long-term minor beneficial effects from the reestablishment of native vegetation.

**Campgrounds:** Relocation and modification of Bullion Campground would affect soils and vegetation. Approximately 400 square feet would be affected, a long-term minor adverse effect. Over time the effects of construction would be diminished as vegetation reestablished, while trampling and compaction from foot traffic would constitute a long-term minor adverse impact. Coarse-textured soils at this site would limit compaction and surface erosion. Vegetation includes scattered Douglas-fir, ponderosa pine, with an understory of kinnickinnick, Oregon grape, serviceberry, spirea, and other forbs, grasses and moss-covered boulders.

#### Restoration and Bioengineering

Restoration in all alternatives would include approximately 5 acres in the former maintenance area, plus areas of former development associated with land purchases and exchanges. Over time, long-term negligible to moderate beneficial effects would be realized as these areas became less visible and more like the surrounding community through additional plant establishment.

### *Additional Impacts from Alternative 1*

#### Road Grade Raise

The Stehekin Valley Road at Milepost 6.25 to Milepost 6.53 (0.28 mile) and Milepost 6.95 to Milepost 7.14 (0.19 mile) would be elevated with imported clean fill and rock. This would affect up to 0.9 acre of existing road surface and up to 0.6 acre on either side, for a total area of 1.5 acres. The placement of fill would result in a negligible to minor short-term impact on vegetation, depending on the rate of vegetation recolonization adjacent to the road. Long-term minor adverse effects would occur from compaction of nearby soils.

#### Road Realignment

For the minor realignment near Milepost 6.0 and construction of a toe wall, there would be both long-term negligible to minor adverse effects on soils and vegetation and short- and long-term minor beneficial effects from stabilizing the slope. Soil would be displaced to implement sight distance improvements, and 5,000 square feet would be affected by the construction of the dry-stacked rock wall, a localized minor adverse effect since the excavated soil and rock would be used to raise the grade of the road and to build the wall. Combined, up to 2.4 acres of existing road and vegetation in a common forest community dominated by Douglas-fir and bigleaf maple would be affected by the realignment and grade raise.

#### Erosion Protection Measures

**Milepost 5.3 (Wilson Creek):** In addition to changes in the location of the road, implementing the Road Improvement Project would result in placement of clusters of rip-rap and log-cribbing at the toe of the slope. This would have additional minor adverse impacts on soils but would not affect vegetation during excavation (there is no vegetation on the bank).

#### Implementation of 1995 Land Protection Plan

Approximately 37 acres could be impacted by development on the currently proposed land exchange parcels. It is likely, however, that not all of this area would be affected. With exchange, it is anticipated that 10 - 15 parcels would be developed with home sites of an average size, including some potential outbuildings, gardens, and utilities, such as septic systems, affecting up to 5,000 square feet per parcel. Current county zoning establishes a five-acre minimum lot size for most areas. Estimating 0.25 mile of road (12 feet wide) for each parcel would add 15,840 square feet each, for a total of up to 0.5 acre. If all 10 - 15 parcels were developed with 5,000 square feet of buildings and a 0.25-mile driveway (though it is likely many would be smaller), direct impacts from development could affect approximately five to eight acres. Because there would be variability in development of the parcels as well as in potential road access, and because actual impacts would likely be smaller, this acreage is likely an overestimate of potential vegetation and soil disturbance. Because there would be no change in the availability of exchange parcels, and because these parcels were identified primarily for scenic and general natural resources values, proposed land exchanges could have long-term minor to moderate adverse effects from development and long-term minor to moderate beneficial effects from acquisition of some high-priority lands, such as riparian areas in the floodplain / channel migration zone.

### *Additional Impacts from Alternative 2*

#### Road Reroute

Approximately 13 acres could be cleared of vegetation within the construction limits for the 16-foot-wide, 1.9-mile-long reroute around McGregor Meadows. Approximately 30,000 cubic yards of cut and 25,000 cubic yards of fill would be excavated and replaced for the roadway, pullouts, and culverts. Estimated clearing would include the road segment plus pullouts and side ditches within the 13 acres. Because much of this area has not been disturbed by human activity except for portions that intersect with the Old Wagon Road, this would constitute a long-term localized moderate adverse effect on soils and both short-term major and long-term moderate localized adverse effects on vegetation, since forested landscape would be converted to new roadway. Because cuts and fills alongside the road would be revegetated and portions of the old road would be restored, over time, initial impacts would be reduced.

Restoration of parts of the bypassed Stehekin Valley Road would have long-term beneficial impacts on 1.4 acres. Although shrubs and forbs would reestablish within the area surrounding the road where cuts and fills were constructed, it would take many years for trees to reestablish. Disturbance would therefore reduce the productivity of soils and vegetation along the reroute corridor, including within adjacent areas disturbed to create cuts or fills within the road corridor

(20 - 25 feet on either side of the proposed road). Topsoil would be removed, structural fill material would be placed on top of the soil, and the road would be surfaced with an asphalt chipseal. Outside the road corridor, after construction, topsoil would be returned to the cleared areas up to the road shoulder and the areas seeded and contoured to allow revegetation to take place. Stabilization by temporary sediment and erosion protection barriers would occur to allow for maximum revegetation and retention of soils, a long-term negligible to moderate beneficial effect, depending on whether it occurred adjacent to the road or in cut and fill areas following disturbance.

The reroute section is located primarily within upland mesic mixed coniferous forest dominated by Douglas-fir that grades to a riparian mixed deciduous / coniferous forest near the Lower Field. Although the reroute has been designed to avoid most of the largest trees, loss of vegetation in this area would include trees, shrubs, forbs, grasses, and ferns, as well as non-vascular plants, such as mosses and lichens. Among the trees that would be removed would be Douglas-fir, western red cedar, bigleaf maple, vine maple, Douglas maple, and ponderosa pine. Among the shrubs that would be removed would be Oregon grape, dogwood, alder, serviceberry, Oregon boxwood, and birch-leaved spirea. Forbs include lupine, wintergreen, dogbane, wild ginger, bead lily, columbine, pipsissewa, yarrow, and many others. Surveys by fire management staff to determine how many trees would be removed by the reroute were based on data from two fire effects plots (each approximately 164 × 66 feet). In these plots were 35 Douglas-fir approximately 20 - 30 inches dbh and seven ponderosa pines in the same size classes. More than 243 other trees between 1 and 20 inches dbh and six snags of undetermined size were also counted. This survey yielded between 209 and 281 mature trees per acre. Another recent survey of areas within the reroute found 55 trees greater than 20 inches dbh, 170 trees between 3 and 20 inches dbh, and 33 trees less than 3 inches dbh, yielding approximately 225 mature trees per acre. Therefore, taking an average of these surveys, it is likely that there would be a loss of approximately 238 trees per acre, or about 3,094 trees over the estimated 13 acres that would be affected by construction of the reroute.

In addition to direct vegetation loss, indirect effects identified in "Impacts of Actions Common to All Alternatives (1 - 5)" would also occur, including changes to the existing soils and plant community over time, such as invasion by nonnative species inadvertently imported in fill or within bare areas remaining from limited rehabilitation / restoration success. In addition, because of the reroute there would be a break in an area of formerly contiguous plant community cover that would result initially in these kinds of changes to the edges of this community that would eventually spread outward. Because there would be more sunlight reaching road edges, the vegetation community could become more diverse over time.

Road and maintenance area relocation would have long-term minor beneficial effects on soil-forming processes and forest dynamics from redevelopment of a riparian zone in the Stehekin River floodplain / channel migration zone.

**McGregor Meadows Access Road Retention:** To retain the 0.8 mile of road into McGregor Meadows, there would be long-term maintenance actions similar to those noted under "Impacts from Actions Common to All Alternatives (1 - 4)," although this access road would be maintained to different standards than the reroute. Approximately 0.3 mile of former road (bypassed by the reroute) would also be retained as a trail and treeless lane to maintain the grade-control structures at Milepost 7.0. Routine maintenance actions would occur within the prism of the access road, over approximately 1.3 acres, and would constitute a long-term minor adverse effect on vegetation and soils.

**Restoration of Stehekin Valley Road Old Alignment:** Maintaining motor vehicle access into McGregor Meadows and allowing for maintenance of grade control structures would limit restoration to approximately 0.7 mile (1.4 acres) of the current Stehekin Valley Road alignment. Revegetation of this abandoned section of road would be accomplished by scraping off gravel, scarifying the road surface, and placing woody debris, and forest litter and duff. Topsoil collected from the reroute areas would also be used to the extent practicable. The area would then be seeded with local native seed and mulched. Natural recruitment of vegetation would also occur. If the cover of native vegetation is considered too low (less than 80 percent) after five years, then seeds and cuttings would be collected from native plants nearby (and nursery grown) to augment planting at the site. Restored vegetation would provide habitat and natural soil retention in the channel migration zone. Where reserved topsoil for the road reroute was not used to rehabilitate cleared areas or for other parts of the actions under these alternatives, it would be used to rehabilitate this road. Because a portion of this section of rehabilitated road would be used for the Lower Valley Trail, not all of this area would be revegetated. Restoration of this area would have a long-term minor beneficial effect.

Where the abandoned road is used for staging, the soil would be temporarily compacted by construction equipment and materials. These would be short-term negligible adverse impacts. Because the reroute rehabilitation areas would also be scarified and topsoil pulled back over the shoulders to allow for better moisture retention, as well as organic material incorporation, and aeration of compacted soils for revegetation activities, there would be short-term negligible adverse and minor long-term beneficial effects.

### Erosion Protection Measures

In addition to actions to stabilize the road near Wilson Creek, the construction of six to eight barbs, a logjam, and a grade-control structure (avulsion sill) and logjam near Boulder Creek would contribute to additional minor localized short- and long-term adverse effects on soils and vegetation from the importation of rock and fill, compaction, loss of plant cover, and other factors. This would be coupled with long-term negligible to minor beneficial effects from bioengineering and reuse of excavated soils in the design of these features. Soil productivity could be retained because barbs and logjams would reduce the rate of erosion, which would, if not implemented, result in the continued loss of soil and riparian vegetation as the riverbank continued to erode.

**Weaver Point:** Actions would be the same as in Alternative 1.

**Stehekin River Mouth:** A new 300-foot-long access road would be built off the main Stehekin Valley Road. The 12-foot-wide road would follow a mostly treeless existing lane, but five to ten trees would be removed at various points. Three rock barbs would also be built along this sparsely vegetated shoreline, currently containing about 100 linear feet of rip-rap on public land. Restoration of the rip-rap area (0.1 acre), bioengineering (0.1 acre), and construction of the barbs would limit bank erosion, including loss of vegetation and soils, on 0.2 acre. There would be a long-term moderate adverse effect on up to 0.5 acre of vegetation and soils alongside the bank and in the adjacent forested area, coupled with long-term minor beneficial effects from bioengineering, removal of the rip-rap, and willow restoration along the bank.

**Milepost 2.0 (Boulder Creek):** The logjam and grade-control structure below Boulder Creek between the Stehekin River channel and the Boulder Creek alluvial fan would affect approximately 0.07 acre of soils and vegetation, including for excavation of the sill and logjam.

In this area, vegetation disturbance would primarily affect a few western red cedars, Douglas-fir, cottonwood, and an understory of forbs, and logs, a localized minor adverse effect on vegetation, combined with localized moderate adverse effects on soils.

**Milepost 3.8 (Frog Island):** One to two barbs at Frog Island and riparian restoration / bioengineering along the bank would affect up to 0.1 acre of soils and vegetation for the barbs, along with 0.1 acre of restoration. Combined, these actions would have a minor, long-term, localized adverse effect, coupled with short-term negligible to minor adverse effects and long-term minor beneficial effects from the restoration.

**Milepost 5.3 (Wilson Creek):** In addition to regrading the slope, two to three rock barbs and bioengineering would be installed. Bioengineering would be used to rehabilitate the slope below the road, while seeding and stabilization would retain the slope above the road. Installation of the barbs and construction of access would have localized short- and long-term minor adverse effects on soils and vegetation, while restoration, including bioengineering, and would have long-term beneficial effects. Because it is likely the access road would continue to be needed, rehabilitation of construction impacts, rather than restoration, would be done.

### Milepost 8.0 Slope Stabilization

Laying back the upper one-quarter to one-third of the steep slope above the road would result in the removal of several dozen small trees and shrubs and disturb topsoil over an area of about 0.2 acre. Scaling (removal) of rocks off the slope would also result in some vegetation disturbance. Together, these actions would result in minor to moderate short-term adverse impacts to soils and vegetation. Among the trees on the slope and at the base of the slope that would be affected would be Douglas-fir, bigleaf maple, red alder, Pacific dogwood, and a few ponderosa pines and silver firs. Existing trees are between six and 48 inches dbh. Approximately two large trees and one snag (between 18 and 48 inches dbh) in addition to other vegetation could be removed. Stabilization of the slope would reduce erosion of soils and side casting of material from the road onto the riverbank. Minor localized long-term beneficial effects would also occur from the ability of more plants to establish on a stable slope.

### Milepost 8.5

Construction of a low water, concrete-plank crossing would require excavation of soil and placement and removal of vegetation, including trees, a minor to moderate localized adverse effect on soils and vegetation. A new, rock-lined outlet channel would be constructed between the low water crossing and the Stehekin River. To minimize tree loss, this channel would be constructed through the most open area. Regardless, it would result in the removal of some soil and vegetation and would therefore affect a small number of trees. Combined, there would be minor to moderate localized adverse effects on vegetation and soils from the loss of vegetation for the low water crossing and the outlet channel.

### Milepost 9.2 Realignment

Construction of a parking area, raising of the road grade, installation of drainage structures and ditches, and surfacing would impact about 0.6 acre, and would require the removal of 10 - 20 small Douglas-fir and lodgepole pines. This would result in localized long-term minor adverse effects on area vegetation and soils.

### Large Woody Debris

Obtaining large woody debris from the tops of logjams from the Stehekin River below Boulder Creek would result in short-term minor adverse effects on vegetation and soils from access equipment and disturbance, coupled with long-term beneficial and adverse effects from use and placement of the woody debris in bank erosion protection measures.

### Recreational Facilities

**Campgrounds / River Access Point:** In addition to the Lower Valley Trail (common to all alternatives), establishment of campsites and river access would affect soils and vegetation over approximately 0.5 acre. Not all of this area would be affected by direct removal of vegetation. Approximately 400 square feet per campsite plus the river access would be affected, a long-term minor adverse effect. Over time the effects of construction would be diminished as vegetation reestablished, while trampling and compaction from foot traffic would constitute a long-term minor adverse impact. Coarse-textured soils at several of these sites would limit compaction and surface erosion.

Vegetation affected at Purple Point Horse Camp would include Douglas-fir, ponderosa pine, and scattered bigleaf maple with an understory of grasses, Oregon grape, and spirea. Rainbow Falls is within a Douglas-fir/ponderosa pine forest with a low-growing understory of kinnickinnick and other forbs.

### Restoration and Bioengineering

Long-term beneficial effects from riparian and upland restoration and bioengineering on 9.1 acres would compensate for some of the adverse effects of excavation and fill in some areas in the lower valley. Although there would be some negligible adverse effects during installation, restoration of native species along the bank of the Stehekin River would contribute to the long-term stabilization of soils and the continuation of natural physical and biotic processes of soil formation and growth of vegetation. In addition to maintenance area restoration (5.0 acres), there would be restoration of approximately 3.3 acres of abandoned Stehekin Valley Road, Stehekin River mouth, Weaver Point, Frog Island, Wilson Creek, Lower Field, and the Buckner Homestead hayfield and pasture, the former maintenance/housing areas, and the former shooting range. Approximately 0.5 acre would also benefit from bioengineering.

Restoration of the Buckner Homestead lower hayfield and pasture would include seeding and planting trees and shrubs over 0.3 acre of Stehekin riverbank, a short-term negligible adverse effect from disturbance (compaction, etc.) during revegetation activities, coupled with a localized long-term moderate beneficial effect that would slow erosion threatening shallow-rooted grasses in this area. Restoration of the Stehekin River bank near the Lower Field would also include seeding and planting of 0.4 acre, resulting in additional short-term negligible adverse effects coupled with long-term moderate beneficial effects. Restoration would be combined with removing the road from this section. Species seeded and planted would include trees and shrubs, including alder, bigleaf maple, cottonwood, and willow.

### Land Protection Plan Modifications

Under the revision to the LPP, approximately 24 acres could be impacted over the long term by future development on the proposed land exchange parcels. Most of the proposed exchange parcels are located within the upland mesic mixed coniferous forest vegetation type, one of the most common in the lower Stehekin Valley. Exceptions to this include areas adjacent to the airstrip, which currently are part of the pasture/disturbed vegetation type (primarily consisting of nonnative species). Exchange parcels are also mainly on gravelly soils, which are not sensitive to compaction or surface erosion. Because the proposed land exchange parcels are more than one acre (1.33 - 7.2 acres) and most of the land from the larger parcels would likely remain undeveloped, development of portions of these 10 - 15 parcels would have a long-term minor to moderate adverse effect on vegetation and soils. Effects would be from conversion of native landscape to developed area and from the potential invasion of nonnative species associated with that development. Negligible to minor beneficial effects would result from stipulations that retained key vegetation characteristics, including from covenants associated with how the parcels would be developed (stipulated in exchange/purchase agreements). Long-term moderate to major beneficial effects would occur from acquiring riparian area parcels in exchange or by direct purchase from removal of development from the Stehekin River floodplain and channel migration zone. Vegetation that could be affected is described in Appendix 8: *Vascular Plants Observed within Proposed Project Areas*.

#### Removal of Buildings and Structures on Acquired and Exchanged Lands

Removal of buildings and structures from acquired and exchanged lands would result in short-term minor adverse impacts on vegetation during removal. Restoration, including seeding or planting local native species, such as maples, dogwood and willow, and using stabilization measures in denuded areas would reduce some impacts. To the extent that cabins and other infrastructure were removed before being claimed by the river or previously disturbed areas were restored, there would be long-term minor to moderate beneficial effects on soils and vegetation.

### *Additional Impacts from Alternative 3*

Most actions from Alternative 2 would also occur in Alternative 3. Impacts would be the same for the housing and maintenance facility replacement and relocation (including former maintenance area restoration), McGregor Meadows Access Road retention, Milepost 8.0 and 9.2 actions, recreational facilities, and implementation of the revised 2010 LPP. Alternative 3, however, would have a shorter reroute, a different array of erosion protection measures (barbs and logjams), and one additional campground.

#### Road Reroute

Vegetation and soils impacts would be similar to those described above for Alternative 2, with approximately 13 acres cleared within the construction limits for the reroute. This would constitute a localized short- and long-term moderate to major adverse effects, since forested landscape would be converted to roadway and vegetation reestablishment would take more than five years. As in Alternative 2, constructing the reroute around McGregor Meadows would require major soil disturbance, with 30,000 cubic yards of cut and 23,000 cubic yards of fill. FHWA road design would balance the cut and fill to the extent practicable to minimize the need to barge in material or to barge out waste. The cut and fill work would result in a long-term localized moderate adverse effect on soils.

### Erosion Protection Measures

**Weaver Point:** There would be long-term minor adverse effects on soils and vegetation from construction of a logjam at this site, combined with localized minor to moderate beneficial effects on 0.18 acre from riparian restoration, bioengineering, and slowing of bank erosion. Construction of the logjam would disturb the bank as far back as 30 feet, but would also protect soils from erosion. Adverse impacts on soils and vegetation would be long term and negligible because the area is comprised of mostly nonnative sod-forming grass. Other plants would be affected in this sparsely vegetation area, including trailing blackberry, horsetail, Himalayan blackberry, and other exotic grasses.

**Stehekin River Mouth:** Instead of three rock barbs in Alternative 2, a large logjam would be constructed to deflect erosion at the bank, a short-term minor to moderate adverse effect on vegetation and a long-term minor adverse effect on soils from excavation to construct the logjam coupled with a long-term minor to moderate beneficial effect from the reestablishment of vegetation in the area. As in Alternative 2, the removal of rip-rap and restoration of a willow riparian area would have a long-term minor beneficial effect

**Boulder Creek:** Actions and impacts would be the same as in Alternative 2 for the logjam / avulsion sill.

**Milepost 3.8 (Frog Island):** Instead of one to two rock barbs and riparian restoration (as in Alternative 2), a logjam would be constructed to retain the road along the bank. Impacts would be long-term and minor on soils and minor to moderate from the removal of riparian vegetation because of the short length of the bank affected. Slowing the erosion of existing native vegetation and replanting would have minor beneficial effects.

**Milepost 5.3 (Wilson Creek) / Lower Field:** The two rock barbs at the upper end of the Lower Field and the logjam at Wilson Creek, coupled with bioengineering, would have long-term minor adverse effects on soils and vegetation and negligible beneficial effects from bioengineering and bank stabilization. Long-term minor to moderate adverse impacts would also be contributed (as in other alternatives) from access to this area. In this alternative, barbs at the Lower Field would help to retain the road and restored riparian area.

### Milepost 8.5

Actions and impacts would be the same as Alternative 2.

### Large Woody Debris

Actions and impacts would the same as Alternative 2.

### Recreational Facilities

**Campgrounds:** Combined effects of actions in Alternative 2 and one additional camp would have a negligible adverse effect in a highly disturbed grassy area near Company Creek with scattered Douglas-fir. Up to 0.3 acre of vegetation and soil (0.1 acre for just the campsites) would be affected, with a series of negligible to minor localized adverse effects from designating campsites and access pathways. Because the raft launch access road would not be constructed in Alternative 3, soil and vegetation impacts at the river mouth would be less than in Alternative 2.

### Restoration and Bioengineering

A slightly shorter section of the abandoned Stehekin Valley Road would be restored (approximately 0.6 mile or 1.0 acre) compared to Alternatives 2 and 5. Adverse impacts would be short term and negligible to minor, while beneficial impacts from restoration of approximately 8.2 acres of upland and riparian areas after impacts would be long term and minor to moderate.

### Land Protection Plan Modifications

Actions and impacts would be the same as in Alternative 2. There would be long-term minor to moderate adverse effects on vegetation and soils coupled with long-term beneficial effects from potential acquisition of riparian areas and from the decrease in development in the floodplain / channel migration zone.

## *Additional Impacts from Alternative 4*

Actions and impacts in Alternative 4 would be the same as Alternative 1 for retaining the Stehekin Valley Road in its current alignment and for maintenance and housing area construction; similar to Alternatives 2, 3 and 5 for restoration of Buckner Homestead hayfield and pasture and the Lower Field; the same as Alternatives 2 - 5 for the retaining wall at Milepost 8.0; and similar to Alternative 3 for erosion protection measures but with new actions at Milepost 7.0 and Milepost 9.2 (five more barbs). For recreational improvements, there would be the additional camp from Alternative 3 and the river access point from Alternatives 2 and 5. There would be less restoration than in Alternative 3 because there would be no road reroute; however, additional bioengineering would occur in areas affected by more barb placement.

### Erosion Protection Measures

**Milepost 2.0 (Boulder Creek):** Actions and impacts would be the same as in Alternatives 2, 3 and 5 for the logjam and avulsion sill.

**Weaver Point / Milepost 5.3 (Wilson Creek) / Lower Field:** Actions and impacts would be the same as in Alternative 3 at Lower Field and at Weaver Point, and the same as in Alternatives 2 and 5 at Wilson Creek.

**Stehekin River Mouth / Milepost 3.8 (Frog Island):** Actions and impacts would be the same as in Alternatives 2 and 5 for the installation of three barbs, bioengineering, and riparian restoration.

### Milepost 8.5

Actions and impacts would be the same as Alternative 2.

### Milepost 7.0 / Milepost 9.2

Construction of two barbs at Milepost 7.0 and three at Milepost 9.2 would affect 0.3 acre. Adverse effects on soils and vegetation would be minor and beneficial effects would be negligible to minor from bioengineering.

### Large Woody Debris

Large woody debris procurement would occur over a larger area than in Alternatives 2, 3 and 5, including areas from the head of the lake up to the Bullion Raft Launch. Procurement of large woody debris from the tops of logjams over a wider area would result in additional short-term moderate adverse effects from equipment disturbance, coupled with long-term minor beneficial and adverse effects from use and placement of the large woody debris in bank erosion protection measures. Obtaining large woody debris from a wider area than in Alternatives 2, 3 and 5 would spread impacts over a wider area, or could result in impacts to areas where wood was more easily obtained, therefore resulting in fewer overall impacts.

### Land Protection Plan Modifications

Implementation of the revised 2010 LPP would allow more development along the existing road alignment and would focus less on moving affected properties out of the channel migration zone. Although priorities for land acquisition and exchange would be different, similar effects (development of up to approximately 2.75 acres for each exchange parcel) could occur. As in Alternatives 2, 3 and 5, because the proposed land exchange parcels are larger than 1 acre and most of the land associated with the larger parcels would likely remain undeveloped, development of portions of these 10 - 15 parcels would have a long-term minor to moderate adverse effect on vegetation and soils, including from conversion of native landscape to developed area and from the potential invasion of nonnative species associated with that development. There would be similar negligible to minor beneficial effects from covenants stipulated in exchange/purchase agreements. Long-term moderate beneficial effects would also occur from acquiring riparian parcels and removal of development from the Stehekin River floodplain and channel migration zone. Because more development would continue to exist in the channel migration zone in Alternative 4 and because there would be fewer high-priority parcels acquired or exchanged, there would continue to be long-term moderate adverse effects on floodplain vegetation and soils.

## *Additional Impacts from Alternative 5*

Actions and impacts would be the same as Alternative 2 except that in addition to the McGregor Meadows Access Road, a Reroute Access Connector would be constructed. There would also be additional grade control structures to minimize the opportunity for avulsion of the McGregor Meadows Access Road; a box culvert rather than a low water crossing would be constructed near Milepost 8.5; and the LPP would be modified in a different way. Although there would be other variations compared to Alternative 2, such as a slightly different alignment for the Lower Valley Trail, overall impacts from these actions would be essentially the same as those described for Alternative 2.

### McGregor Meadows Access Road

If, at some point, a portion of this road was no longer needed, it would be restored and could result in long-term beneficial effects from restoration of an area of up to approximately 1.2 acres.

### Reroute Access Connector

Constructing a Reroute Access Connector (12 feet wide and 940 - 1,200 feet long) would result in additional disturbance of soils and vegetation over approximately 1.0 - 1.2 acres. This total was derived by estimating an additional 30 feet of disturbance for the first 30 feet of the road, where it descends from the reroute and 6-7 feet of disturbance on either side of the road beyond that. The lower part of the road crosses a palustrine-scrub-shrub wetland (including vine maple and red osier dogwood) that has fine-grained soils. As a result, impacts from construction of the road would be moderate and long-term. Loss of vegetation and compaction of soils in this area would affect a plant community adapted to the periodic presence of water. When built, however, the connector road through the wetland would be at grade and would not impede water flow (i.e. it would flood during periods of high water). This connector would be extended through private property in McGregor Meadows to connect with a portion of the McGregor Meadows Access Road.

### Grade Control Structures (Alternative 5)

Although construction of these would affect soils, they would have minimal effects on vegetation since they would be constructed almost exclusively within existing disturbed areas (including two driveways and a road). Excavation for these could affect some existing roadside vegetation where it lies adjacent to the driveways or roadway. Approximately 0.14 acres would be affected by construction of these features, which are typically six feet wide and three feet deep.

### Erosion Protection Measures

**Milepost 8.5:** Instead of the low water crossing that would be constructed in Alternatives 2 - 4, a concrete box culvert with a removable lid would be used in Alternative 5. Constructing the box culvert would require raising the road approximately four feet over a distance of 450 feet, an action that would require approximately 1,500 cubic yards of fill. In addition, to construct the culvert and raise the road, approximately eight large cottonwood trees that have grown up in the roadside ditch would likely be removed. As in other alternatives, a lined outlet channel would be constructed between the culvert and the Stehekin River. To minimize tree loss, this channel would be constructed through the most open area but because it would result in the removal of soil and vegetation would likely affect a small number of trees. Combined, there would be minor to moderate adverse effects on vegetation and soils from the loss of vegetation and the importation of fill. Between the culvert modifications and the turnout that would be constructed in this area more than 50 trees between 5 and 40 inches would be removed. These would include the cottonwoods noted above, as well as ponderosa pines, Douglas-fir, big-leaf maple and Pacific dogwood.

### Land Protection Plan Modifications (Alternative 5)

Under a revision to the LPP, approximately 29 acres could be affected by future development of proposed land exchange parcels. These areas would be comprised of the same 24 acres in Alternative 2 plus an additional 0.6 acre parcel near the Bakery that could be used as a pasture or for agriculture and a 5-acre parcel near the Stehekin Valley Ranch that has previously been affected by development. More land (up to 2.75 additional acres) than the 5-8 acres that were estimated in Alternative 2 could be affected if each of these parcels was developed with an access road and a single-family dwelling. Other adverse and beneficial effects, including the potential for invasion by nonnative species and from the conversion of native landscape to a developed landscape, would be the same as those described in Alternative 2. Overall, these would be long-term and localized and minor to major.

## Measures to Avoid, Minimize, or Mitigate Impacts

- Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to soils include the following:
- Locating staging areas where they would minimize new disturbance of area soils and vegetation.
- Minimizing ground disturbance to the extent practicable.
- Minimizing construction along water courses during periods of heavy precipitation.
- Minimizing driving over or compacting root-zones.
- Using mats or plywood to minimize soil compaction impacts in wetlands.
- Salvaging topsoil from excavated areas for use in recovering source area or other project areas.
- Windrowing topsoil at a height that would help to preserve soil microorganisms (less than three feet).
- Avoiding leaving excavated soil alongside trees, and providing tree protection if needed for specimen trees.
- Reusing excavated materials where possible in the project area.
- Revegetating project areas through native seeding and planting.
- Importing weed-free clean fill.
- Storing imported topsoil and fill in a weed free area and covered by weed cloth to prevent contamination.
- Identifying clearing limits to minimize the amount of vegetation loss.
- Clearing and grubbing only those areas where construction would occur.
- Reusing topsoil from the reroute areas, to the extent practicable, to obliterate and revegetate abandoned road sections.
- Preparing and approving a Hazardous Spill Plan or Spill Prevention Containment and Control Plan (SPCC), whichever is appropriate, before construction begins.
- Encouraging the use of non-petroleum based hydraulic fluid in heavy equipment.

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to vegetation include the following:

- Minimizing construction limits and areas to be cleared where possible.

- Clearly identifying the construction limits, to prevent expansion of construction operations into undisturbed areas.
- Revegetating road reroute clearing areas not occupied by the roadway.
- Retaining specimen trees where possible adjacent to erosion protection sites and along the reroute / realignment areas (as identified by park staff).
- Salvaging plant material, prior to construction, from areas to be disturbed.
- Replanting salvaged plants on reroute side slopes and obliterated areas to accelerate site recovery and to reduce the opportunity for exotic species to establish (Alternatives 2, 3 and 5).
- Continuing to use CCRs associated with the development of exchanged lands to address clearing of vegetation; location and design of access roads and utilities; density, height, design, and color of visible development; and access for management of natural and cultural resources.
- Restoring staging and other temporarily impacted areas following construction.
- Obliterating and revegetating abandoned road segments and areas disturbed by construction with native plant species.
- Using bioengineering techniques, such as willow layering, to stabilize riverbanks.
- Minimizing actions that affect endangered, threatened, or sensitive plant species in the project area.
- Keeping fill slopes as steep as possible where fill is proposed to raise the road to minimize the disturbance footprint.
- Minimizing clearing of vegetation associated with reroutes by incorporating toe walls at appropriate locations (Alternatives 2 and 3).
- Conduct additional surveys for sensitive species, particularly where erosion protection measures or recreational facilities would be constructed.

Mitigation measures for preventing the spread of noxious weeds include the following:

- Importing certified weed free materials from outside Lake Chelan NRA.
- Avoiding the use of stockpiled materials from the Company Creek Pit unless designated for the project.
- Washing all vehicles prior to barging to Stehekin. This includes all vehicles, but especially those that have come into contact with soil or materials that may contain noxious weed seed prior to working in weed-free areas or transporting weed-free materials.
- Covering stored soil and rock, as appropriate, to prevent exposure to noxious weed seed.
- Separating contaminated soil from weed-free soil and using the contaminated soil for subsurface fill.

- Conducting annual monitoring for potential weed infestation using early detection / rapid response eradication techniques.
- Identifying and controlling exotic plant species infestations prior to construction (especially associated with the airstrip and old roads).

## Cumulative Impacts

Over time, habitat modification within Lake Chelan NRA has included broad-scale changes in vegetation characteristics due to fire suppression and protection activities, and administrative and private development. Projects noted in Appendix 5 and others like these have resulted in loss of native vegetation where land has been developed for facilities, trails, and roads, and for private homes and businesses. Development, including roads, private property, and Lake Chelan NRA administrative facilities, in the Stehekin Valley currently affects approximately 283 acres of the approximately 2,550 acres on the valley floor between Lake Chelan and High Bridge. The original 23-mile road development project disturbed approximately 50 acres of vegetation and soils (NPS LACH 2005a). Combined, past actions have had localized moderate long-term adverse impacts on soils and vegetation due to the increased impervious surface, decreased infiltration, soil compaction, loss of soil moisture, and loss or alteration of organic soil horizon as well as from the loss of vegetation. These impacts have been spread over much of the lower Stehekin Valley, occurring mostly within the channel migration zone of the Stehekin River.

When the effects of development are combined with those from past specific projects along the Stehekin Valley and Company Creek roads to build the levee, rock barbs, grade-control structures, and other features, there have been minor to moderate cumulative adverse impacts on soils and vegetation, especially in riparian areas. The Forest Fuel Reduction Program has also impacted soils and vegetation in the lower Stehekin Valley by thinning (removing) trees, snags, downed woody debris, and other vegetation to reduce the potential for ground fuels to carry fire near developed areas. Approximately 1,426 acres have had some treatment. Overall development has contributed to the introduction and spread of nonnative (including invasive) species. Approximately 213 acres have been converted to primarily nonnative species. (Actions to reduce the distribution and spread of nonnative invasive species, however, have been effective in some areas.) Similarly, acquisition of land and the purchase of scenic easements since 1968 have resulted in cumulative beneficial impacts to soil and vegetation in the lower valley.

Past projects to relocate the Stehekin Valley Road have resulted in several reroutes along with similar areas of restoration. In addition, a series of erosion protection measures at 46 sites, including rock barbs, grade-control structures, and other features, have affected 1.6 miles of riverbank. Use of bioengineering and rock barbs since the 1990s has mitigated some impacts that would have occurred with extensive placement of rip-rap.

Alternatives 1 - 5 would contribute additional cumulative minor adverse and minor to major beneficial effects from the replacement and relocation of the housing and maintenance complex. Alternatives 1 and 4 would also contribute additional negligible to moderate adverse effects from continuing to maintain the Stehekin Valley Road in place and localized moderate adverse effects to soils and vegetation by adding 16 to 17 additional rock barbs either as part of the implementation of this plan (Alternative 4) or later as the need arose (Alternative 1). Alternatives 2, 3 and 5 would contribute cumulative moderate adverse effects from clearing and grading the reroutes and cumulative minor to moderate beneficial effects from moving the road out of the floodplain and channel migration zone. Over time, conversion of McGregor Meadows back to riparian vegetation would contribute minor to moderate cumulative beneficial effects. Recreational facility development would be similar under Alternatives 2 - 5 (3.2 - 3.7 acres total with 1.7 - 2.0 acres of new development), with slightly more effects in Alternatives 4 from more new trail development, Alternatives 3 and 4 from one additional camp. Alternatives 2 - 5 would also contribute new localized moderate to major beneficial effects from restoration at Buckner Homestead hayfield and pasture, the Lower Field, acquired private land in the channel migration zone, and the former maintenance yard and housing area, depending on the effectiveness of the restoration. Alternatives 2, 3 and 5 would also include some restoration from the former roadway in McGregor Meadows and would contribute additional negligible to minor cumulative beneficial effects from minimizing effects on soils by retaining topsoil for the road reroutes.

Most of Lake Chelan NRA continues to be undisturbed by human impacts but the low-elevation riparian zone of the lower Stehekin Valley that would be affected represents only two percent of the overall watershed. Therefore, the amount of area affected by past and possible future project soil and vegetation impacts is moderate when considered within the context of the Stehekin River watershed or the lower Stehekin Valley. Impacts from the past actions, together with the impacts of implementing one of the alternatives, would continue to result in a range of localized negligible to moderate adverse and negligible to moderate beneficial cumulative impacts to soils and vegetation in Lake Chelan NRA.

In Alternative 1, future adverse impacts to soils and vegetation would continue to occur from road maintenance. Over time, it is likely that the measures to keep the road in place now proposed in Alternative 4 would be implemented in Alternative 1 and impacts would be expected to increase as the river continues to encroach on the road. Long-term minor to moderate cumulative adverse effects on soils and vegetation would continue to occur from maintaining the Company Creek Road in its current alignment.

Alternatives 2, 3 and 5 would contribute fewer cumulative impacts to soils because the Stehekin Valley Road would be moved away from the channel migration zone where possible, thus limiting the future extent of flooding on the road, and impacts to soils and vegetation within the riparian zone (these impacts would be least in Alternatives 2 and 5). In some areas, where the road is adjacent to steep terrain and cannot be moved without major additional impacts on vegetation, additional minor impacts could continue to occur from erosion of soils and loss of vegetation. As in Alternative 1, ongoing effects would occur from maintaining the Company Creek Road in its current alignment. Alternative 4, compared to Alternative 1, would also likely contribute fewer cumulative impacts on soils and vegetation because more erosion protection measures would be constructed. Primarily as a result of the reroutes, Alternatives 2, 3 and 5 would have moderate cumulative adverse effects on soils and vegetation coupled with some beneficial effects on floodplain and wetland soils and vegetation.

## Conclusion

Alternative 1 would have negligible to moderate adverse and negligible to major beneficial effects. Alternatives 2 and 5 would have negligible to major beneficial and adverse effects. Alternative 3 would have impacts similar to Alternative 2, with adverse and beneficial effects both somewhat less from a shorter reroute, less restoration, and more erosion protection measures. Alternative 4 would have negligible to moderate adverse effects and minor to major beneficial effects similar to Alternative 1. In Alternative 1, there would be approximately ten acres of new disturbance. In Alternatives 2, 3 and 5, an additional 13 acres would be disturbed for the road reroutes. In total, Alternatives 2 and 3 would have approximately 23 acres of new disturbance and Alternative 4 would have approximately 11 acres of new disturbance. Alternative 5 could have up to 24 acres of new disturbance. Restoration in all alternatives would improve soils and vegetation on from 5.1 (Alternative 1) to 9.0 acres (Alternatives 2 and 5). Eventually, an additional 1.5 acres could be restored if the McGregor Meadows Access Road were no longer needed in Alternative 2 - 3 and additional area for the Connector in Alternative 5. The range of impacts is summarized in Table IV-6: *Summary of Soils and Vegetation Impacts*.

**Table IV-6: Summary of Soils and Vegetation Impacts**

| Action | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| Maintenance and housing areas | Localized long-term minor to moderate adverse effects to upland vegetation.<br>Long-term negligible to major beneficial effects from riparian and upland restoration. | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 |
| Road rehabilitation | Long-term negligible to moderate adverse effects.<br>Long-term negligible to minor beneficial effects. | Long-term negligible to moderate adverse effects.<br>Long-term negligible to minor beneficial effects. | Similar to Alternatives 2 and 5 | Same as Alternative 1 |
| Grade raise | Short- to long-term negligible to minor adverse effects. | N/A | N/A | Same as Alternative 1 |
| Reroute | N/A | Short- and long-term localized moderate to major adverse effects;<br>Long-term negligible to moderate beneficial effects. | Similar to Alternatives 2 and 5, with slightly shorter reroute | N/A |
| McGregor Meadows Access Road | N/A | Long-term minor adverse effects. | Long-term minor adverse effects. | N/A |
| Reroute Access Connector | N/A | Alternative 2<br>Long-term minor adverse effects (Alt 5) | N/A | N/A |

| Action | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
| --- | --- | --- | --- | --- |
| Erosion protection measures | Short- and long-term minor adverse effects; Long-term negligible beneficial effects. | Short- and long-term minor to moderate adverse effects; Long-term negligible to minor or moderate beneficial effects. | Similar to Alternatives 2 and 5, with fewer barbs and more logjams. | Short- and long-term minor to moderate adverse effects, with more barbs than Alternative 3; Long-term negligible to minor beneficial effects. |
| Milepost 8.0 / 9.2 | N/A | Long-term localized minor to moderate adverse effects. Long-term minor beneficial effects. | Same as Alternatives 2and 5 | Same as Alternatives 2 and 5 |
| Large woody debris | No effects. | Short- and long-term negligible to minor adverse effects. Long-term minor beneficial effects. | Same as Alternatives 2 and 5 | Similar to Alternatives 2 and 5, with moderate impacts spread over a wider area. |
| Recreational facilities | Long-term minor adverse effects; long-term negligible beneficial effects. | Long-term minor adverse effects; Long-term negligible beneficial effects. | Similar to Alternative 2 with one more camp and no river access point. | Similar to Alternative 2 with one more camp. |
| Restoration and bioengineering | Long-term beneficial effects from restoration of former maintenance area. | Same as Alternative 1, plus long-term minor to major beneficial effects from additional restoration and bioengineering. | Same as Alternatives 2 and 5, with slightly less road restoration. | Similar to Alternatives 2 and 5, but with fewer beneficial effects. |
| Land Protection Plan | Long-term minor to moderate adverse and beneficial effects. | Long-term minor to moderate adverse effects. Long-term moderate to major beneficial effects. | Same as Alternatives 2 and 5 | Same as Alternatives 2 and 5, with fewer potential beneficial effects. |
| Conclusion | Negligible to moderate adverse effects. Negligible to minor beneficial impacts. | Negligible to major adverse effects. Negligible to moderate beneficial impacts. | Similar to Alternatives 2 and 5; however, both adverse and beneficial effects would be somewhat less from a shorter reroute. | Minor to moderate adverse impacts. Minor beneficial effects. |
| Contribution to cumulative impacts | Localized minor adverse cumulative impacts and localized negligible to minor beneficial effects. | Localized moderate adverse cumulative impacts and localized minor beneficial impacts. | Similar to Alternatives 2 and 5. | Minor to moderate cumulative adverse effects. |

# 4. Geologic Hazards Impacts

## Geologic Hazards Methodology

Geologic hazards were mapped for the 1995 GMP, and were used to qualitatively assess beneficial and adverse impacts of actions in the alternatives.

**Type of Impact:** As a natural area, a variety of geologic hazards, including rock fall, snow avalanches, and hazards associated with extreme storm events, such as floods and debris flows, occur within Lake Chelan NRA. Given the many types of hazards present in Stehekin Valley, it is not feasible to remove all roads, trails, and camps from geologic hazard zones. The rationale for maintaining some facilities in flood and debris flow hazard zones is given below, but is expanded upon in Appendix 17: *Draft Wetlands and Floodplains Statement of Findings*.

Some of the alternatives in this plan change exposure of people to geological hazards. Beneficial impacts would reduce the potential exposure of human development and activities to geologic hazards; adverse impacts would increase exposure to known hazards.

**Intensity of Impact:**

- **Negligible:** Alternative actions would result in a change in the exposure from one geologic hazard to another, when the hazards have a similar frequency. For example, this could occur if a road was moved from out of the channel migration zone of the river to an alluvial fan migration zone.
- **Minor:** Actions would result in continued occupation of a site in a geologic hazard zone where events were infrequent and advanced warning of an event was likely.
- **Moderate:** Alternative actions would result in a measurable increase or decrease in exposure to geologic hazards that were infrequent and where advanced warning of an event was likely.
- **Major:** Alternative actions would result in an increase or decrease in the exposure of vulnerable individuals to active geologic hazards. For example, this could include building new housing in an active debris flow hazard zone.

## Impacts from Geologic Hazards

### *Impacts from Alternative 1*

Ongoing moderate adverse effects from geologic hazards would continue along the Stehekin Valley Road and in other areas from rock falls at the south end of McGregor Meadows, at Frog Island, below cliffs at Rainbow Falls, and near Harlequin Bridge. Slope instability at Milepost 8.0 also represents a rock fall hazard. Swift, deep water during floods along the Stehekin River channel and its tributaries is also a major hazard. A number of facilities including Stehekin Landing and Purple Point Campground are located on debris cones. The potential for injury or damage from these hazards would remain as a long-term minor to moderate adverse effect. There would also continue to be ongoing exposure to flood hazards on the Stehekin Valley Road and Company Creek Roads and at Harlequin Camp, creating repeated short-term localized minor adverse effects. The new maintenance area and housing would be outside of geologic hazard (floodplain / channel migration) zones, a long-term moderate beneficial effect.

There would also be some new risk associated with new or relocated recreational facilities along the Stehekin River at Bullion Camp. Given that both the old and new sites are in the channel migration zone, and that flood events there would be infrequent with advanced warning times, the impact would be minor.

### *Impacts from Actions Common to Alternatives 2, 3 and 5*

Impacts from Alternatives 2, 3 and 5 would be the same as Alternative 1, except for those associated with Milepost 8.0 and those associated with most flood hazards on the Stehekin Valley Road. In addition, actions to close Harlequin during periods of flooding would decrease exposure to hazards there. Actions at Milepost 8.0 would reduce the rockfall hazard, resulting in a long-term beneficial effect. Unlike Alternative 1, Alternatives 2, 3 and 5 would also eliminate exposure to the considerable hazard in the Stehekin River floodplain by rerouting 1.8 miles (Alternatives 2 and 5) or 1.6 miles (Alternative 3) of road. The proposed reroute crosses several debris cones where natural events over thousands of years have deposited sand, gravel and rocks of various sizes. One of these carried a snow avalanche to just above the proposed road reroute site in 2008. Given the higher frequency of flood events on the river compared to snow avalanches or debris flows, the reroute would result in a lower likelihood of exposure to geologic hazards; hazards would be different, but would continue to be negligible to minor.

Construction of a campground at Rainbow Falls would place visitors near a rock fall hazard. Locating campsites according to site-specific conditions, and the fact that most rock falls occur in the winter when the camp would be closed by snow, would reduce the impact to minor. Exposure to hazards along the Stehekin Valley Road in McGregor Meadows would be reduced the most in Alternatives 2, 3 and 5; however, because the access road would remain, there would continue to be minor exposure to flood hazards for some residents and visitors. There would also be some new risk associated with new or relocated recreational facilities along the Stehekin River and at Bullion Camp. Construction of new visitor facilities near the river mouth in Alternatives 2 and 5 would also create a minor adverse effect during high flow periods on the river.

### *Impacts from Alternative 4*

Impacts would be the same as Alternative 1, plus Alternative 4 would also reduce slope hazard at Milepost 8.0, a localized minor to moderate long-term beneficial effect. As in Alternatives 2 and 5, there would be long-term minor to moderate adverse effects from exposure to geologic hazards from recreational facilities at Rainbow Falls and Bullion Camp and at the river access point near the river mouth.

## Cumulative Impacts

Regardless of past, present and future actions, a variety of potential minor to moderate adverse effects from geologic hazards would continue to exist. Over time, actions, including development within the Stehekin Valley, (in a floodplain, alongside a mountain river, and near steep-sided cliffs), has contributed to potential increases in exposure to geologic hazards. Although Alternatives 1-5 would reduce the amount of developed area in floodplains over time, the overall range and amount of development in the Stehekin Valley would remain and would continue to contribute minor to moderate adverse cumulative effects from geologic hazards for both residents and visitors. Relocation of the road out of the floodplain / channel migration zone in Alternatives 2, 3 and 5 would reduce exposure to hazards from flooding, but exposure to hazards would continue to be minor to moderate from less frequent debris flows in some steep sections of the reroute. Beneficial effects would primarily be contributed in Alternatives 2 - 5 by reducing slope hazards at Milepost 8.0, and from reducing exposure related to recreational activities, such as at Harlequin Camp in Alternatives 2 - 5 and from the river access point in Alternatives 2, 4 and 5. Alternatives 1 - 5 would therefore continue to have minor cumulative adverse impacts.

## Conclusion

Alternatives 1 - 5 would continue to result in minor to moderate exposure to geologic hazards. Some exposure would be reduced, such as flood hazard at Harlequin (Alternatives 2 - 5), while other exposure would be similar, such as from flooding along the road in Alternatives 1 and 4. Moving Bullion Camp across the road would slightly increase its exposure to flood hazards, while decreasing exposure to tree falling hazards. Similarly, adding campsites at Rainbow Falls in Alternatives 2 - 5 would increase rockfall exposure but would be mitigated by closure or low use of the campsites in winter. Alternatives 2, 3 and 5 would reduce exposure to hazards from swift water and unstable stream banks along the roadway by implementing the reroute but would have minor to moderate exposure to debris flow and rockfall hazards along the reroute. Alternatives 2 - 5 would have long-term beneficial impacts from stabilizing the slope at Milepost 8.0 and from reducing exposure to geologic hazards associated with some recreational use.

Overall impacts (exposure) associated with geologic hazards would continue to be minor to moderate.

Photo 30 – Stehekin River at its junction with Lake Chelan.

# 5. Hydraulics and Streamflow Impacts

## Water Resources Methodology: Hydraulics and Stream Flow

Water resources analysis was based on a qualitative assessment of water resources and typical effects of the action described. For the action alternatives, quantitative analysis was used for determining effects such as the number of new culverts, effect on river processes, and cumulative effects by reach and for the entire lower Stehekin River.

**Type of Impact:** Types of stream flow and hydraulic impacts include changes in the velocity, and depth of water. Beneficial impacts would protect these conditions or restore natural processes and conditions in the channel migration zone to allow floodwaters to spread out during large events, slowing overall riverbank flow velocity and reducing flood hazard in developed areas. Adverse impacts would interrupt natural processes of bank erosion and stream flow, such as increasing erosion and floodwater elevations on adjacent properties.

Actions that increase the amount of impervious surfacing (such as construction of buildings, surfacing, or grading); and actions that encroach upon the Stehekin River (such as barbs or logjams) or the route of water toward the Stehekin River (such as culverts and side ditches) would affect hydrology and stream flow. Impervious surfaces and loss of vegetation may result in faster runoff into culverts, side ditches and other drainage features. Barbs and logjams and other erosion features can alter the natural processes of bank erosion and stream migration and represent long-term impacts.

A *Draft Wetlands and Floodplains Statement of Findings* is included as Appendix 17 to document potential impacts to streamflow and hydraulics from the preferred alternative.

**Intensity of Impact:**

- **Negligible:** Alternative actions would result in a change in streamflow conditions, but the change would not be measurable or perceptible at the reach scale or the lower valley scale.
- **Minor:** Alternative actions would result in modification of streamflow and hydraulics within a given reach by actions to protect the road at the edge of the channel migration zone. It would increase impervious surfacing, and the measurable or anticipated degree of change would be detectable.
- **Moderate:** Alternative actions would result in modification of streamflow and hydraulics within a given reach by actions to protect the road within the channel migration zone. Some erosion protection measures would be within the channel migration zone. It would noticeably increase impervious surfacing, and the measurable or anticipated degree of change would be readily apparent and appreciable.
- **Major:** Alternative actions would result in modification of streamflow and hydraulics within a given reach and along a major portion of the river in the lower Stehekin Valley. Most erosion protection measures would be within the channel migration zone, limiting long-term river migration and restricting the river from utilizing its floodplain. The measurable or anticipated degree of change would be substantial, causing a highly noticeable change.

## Hydraulics and Streamflow Impacts

### *General Effects of Rock Barbs*

Rock barbs have a localized effect by directing the stream away from the riverbank and creating eddies or pools, but do not generally change the overall flow regime in the river (NPS LACH 1995a). As noted in the Stehekin Valley Road Improvement Plan Environmental Assessment (EA), while barbs protect the immediate area by deflecting streamflow away from the bank, the altered streamflow can but usually does not result in major riverbank erosion farther downstream (NPS LACH 2005a). ). Observations indicate that barbs affect the riverbank and channel for up to about four times their length (25 feet), or about 100 feet downstream.

If the erosion problem migrates downstream and it becomes necessary to construct additional erosion protection measures, this would result in additional impacts on the Stehekin River and its banks. When located within the channel migration zone, barbs or other structures can limit stream migration and potentially increase stream velocity and depth. When located at the edge of the channel migration zone, such as against a valley wall or alluvial fan, the impact of erosion protection structures on river processes is comparatively small since these topographic features naturally limit river migration.

Results of computer modeling at a local scale are consistent with field observations of rock barbs in the Stehekin River and elsewhere. Water surface elevation increases one foot immediately upstream of the barbs and is lowered downstream by a similar amount. This is accompanied by a shift of high-velocity flow from the bank toward the mid-channel area. These displacements combine to reduce the energy of flow along the affected riverbank. Examination of the effects of rock barbs two channel-widths downstream show that the water surface elevation is not affected; however, downstream velocity is slightly reduced (NPS LACH 1997).

Barbs also unnaturally increase the diversity of habitats in the Stehekin River at the reach scale by increasing the amount of pool habitat compared to the amount of riffle habitat. Pools are less frequently observed on the Stehekin River than riffles, which are the most common habitat type in the main channel of the Stehekin River (Appendix 4: *Stehekin River Reach Analysis*). Rock barbs create pool habitat (eddies or "pocket pools") upstream and downstream of individual barbs. This effect results in an overall change to instream flow, wherever barbs are inserted. As with other bank-hardening measures, barbs also reduce the amount of large woody debris and gravel recruitment from the bank where they are located. Because the rate of large woody debris and gravel recruitment is very high in the Stehekin River, no wood is incorporated by erosion of a road bed, and the areas of bank hardening relatively small in comparison to the entire system, impacts from bank hardening impacts would be long term, minor, and adverse. A summary of the current status of altered stream banks in the four reaches impacted by this implementation plan is in Appendix 4 and Table IV-7.

Barbs do not cause increases in flooding of overbank areas because they are designed to be topped by high flows. Most of their effect is directed laterally away from the bank, and as a result they do not increase floodwater surface elevation in large overbank areas.

Rock barbs are effective over periods of 5 to 30 years or more, depending on location. In areas of rapid gravel accumulation, they may be buried by a single event. In areas where there is less gravel movement, they can be effective for several decades. Rock barbs may require repairs after large floods.

**Table IV-7: Percentage of Bank Currently Affected by Erosion Protection Measures in Reaches 1 - 4 and Bank that would be Affected by Proposed Actions in Alternatives 1 - 5**

| Action | Bank Currently Affected (%) | Alternative 1 (%) | Alternatives 2 and 5 (%) | Alternative 3 (%) | Alternative 4 (%) |
|---|---|---|---|---|---|
| Reach 1 | 10 (304/3,000 m) | 0 | 9 (270 m) | 13 (396 m) | 15 (436 m) |
| Reach 2 | 4 (92/2,400 m) | 0 | 5 (122 m) | 5 (122 m) | 5 (122 m) |
| Reach 3 | 3 (92/3,000 m) | 4 (120 m) | 4 (122 m) | 4 (122 m) | 4 (122 m) |
| Reach 4 | 22 (884/4,000 m) | 0 | 0 | 3 (122 m) | 6 (244 m) |

*Note: See Figure IV-1 and Appendix 4: Stehekin River Reach Analysis for location of reaches.*

### *General Effects of Logjams*

Constructed logjams are, in general, similar to rock barbs in that they deflect and absorb energy to slow bank erosion, and cause local pool formation by creating turbulence that erodes a scour hole into the bed of the stream. They are composed of logs, often cabled together, and anchored or buried or pinned to the bank. Their installation requires more excavation of the bank over a wider area than for barbs. They offer the advantage of being made from native material that is often far less costly than imported rock. Logjams also offer the advantage of allowing the beneficial effects of large woody debris to be used effectively to create habitat for fish, amphibians, and aquatic insects.

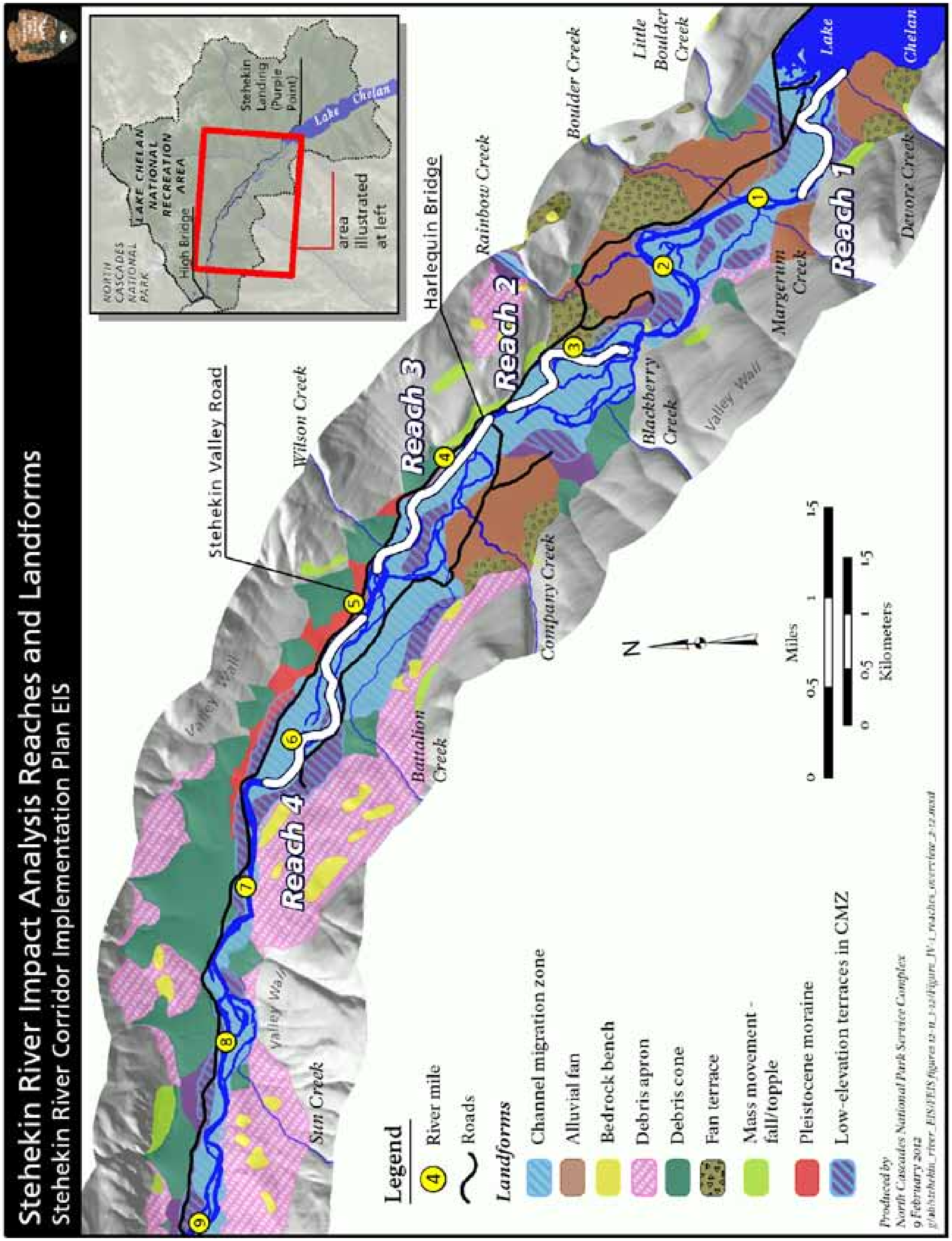
When placed in the wrong location, logjams can cause unwanted bank erosion when water flows around the obstruction. Logjams can also present a hazard to river runners. The use of logjams on the Stehekin River can be viewed in two ways. On one hand, there are currently 166 logjams, and adding 2 - 3 more would therefore have a negligible to minor effect. On the other hand, adding logjams to locations where they do not naturally form may have unforeseen effects and increase hazards.

### *General Effects of Levees*

Levees are long features along a riverbank that are tall enough not to be topped by a given flood event. While they can provide some local relief from flooding, they can cause minor to major long-term impacts to flooding and river processes over wide areas. By preventing floodwater from occupying major parts of the floodplain, levees raise floodwater levels on the opposite side of the river and downstream. By keeping floodwater in the channel, levees also increase water velocity, channel and bank erosion, and floodwater elevation downstream.

The impact of levees is directly related to their height, length, and location. Tall, long levees adjacent to the river channel can have significant long-term adverse impacts to streamflow and hydraulics. Short, low levees set back from the river have smaller effects.

**Figure IV-1: Layout of the Stream Reaches Analyzed on the Stehekin River**




*Note the Pleistocene moraine (red) along the left bank and the alluvial fans (brown) along the lower valley, which generally define the channel migration zone.*

### *Impacts from Actions Common to Alternatives 1 - 5*

#### Existing Development

The Stehekin Valley and Company Creek roads and other Stehekin watershed development have constrained the Stehekin River from moving naturally across its floodplain and channel migration zone in some areas. In many cases this development lies adjacent to the river within the floodplain or channel migration zone. There would continue to be long-term moderate to major adverse effects from retaining the Company Creek Road and levee, which constrains the Stehekin River from occupying about a third of its channel migration zone.

Under all alternatives, parts of the Stehekin Valley Road would be retained adjacent to the Stehekin River within the floodplain / channel migration zone because there is not room to move the road due to topographic features and/or because of the need for very long reroutes through sensitive resources.

All alternatives would retain the Stehekin Valley Road within the channel migration zone between Milepost 1.0 and 1.5 (from the head of the lake to the Bakery). In this location the road is at grade and does not have a large impact on the floodplain. All alternatives would also keep the road at the edge of the channel migration zone near Milepost 3.8 (Frog Island), Milepost 5.3 (Wilson Creek), and Milepost 8.0. At these sites, the Stehekin Valley Road does not significantly constrict the river within the channel migration zone because the road is located at its edge and where it would be naturally constrained by topography.

About 0.5 mile of the road into McGregor Meadows would remain in the floodplain until no private property access was needed (Alternatives 2, 3 and 5). In Alternatives 1 and 4, the road would run for about 0.8 mile through the floodplain, and would be raised one to three feet with 5,600 yards of fill. The low elevation of the floodplain and deposition of gravel in the channel have led to a long-term trend toward increased flooding in this area as the river seeks a new channel. Impacts from keeping a road in this location (either the access road or the Stehekin Valley Road) would therefore be moderate over time as the river flowed over or against the road.

Existing development along the Company Creek Road and most of the road itself would continue to affect the ability of the river to migrate laterally within the channel migration zone on the opposite side of the river from McGregor Meadows. The retention of the road would continue to result in a long-term moderate adverse effect on the natural flow and channel changes in the Stehekin River since the Company Creek bank of the river is several feet higher than McGregor Meadows and the right bank floodplain is not as wide.

#### Road Rehabilitation

Actions that concentrate runoff into culverts or ditches or sediment flows to new, unstable areas would have a variety of localized to minor to moderate adverse effects on hydraulics and streamflow. These actions include excavation, placement of fill, loss of vegetation, and surfacing existing gravel portions of the Stehekin Valley Road. With surfacing, erosion of fill on the roadway during flooding would diminish, a long-term beneficial effect.

**Culverts / Side Ditches:** Rehabilitation actions for the whole road (Alternatives 1 and 4) and for the area before and after the reroutes (Alternatives 2, 3 and 5) would affect existing culverts (approximately 19) and would substantially increase the number of culverts. Culverts would be extended, removed, or replaced, affecting intermittent and perennial streamflows to varying degrees, depending on the location and type of culvert. Because sediment barriers and diversion would be employed, as appropriate, and work would comply with in-water work guidelines, effects on streamflow for small tributaries between Harlequin Bridge and Milepost 9.2 would be short term and minor. Similarly, constructing new side ditches in Alternatives 1 and 4 and additional side ditches over the length of the reroutes in Alternatives 2, 3 and 5 would have minor adverse effects on streamflow. Long-term beneficial effects would occur from improved drainage along and beneath the Stehekin Valley Road.

**Water Withdrawal:** There would be negligible adverse effects on streamflow from the periodic withdrawal of water (of more than a million gallons over three months) accessed from previously disturbed sites along the Stehekin Valley Road.

#### Maintenance Facility and Housing Replacement and Relocation

Replacement and relocation of the maintenance facility and housing from within the floodplain / channel migration zone and constructing new and replacement facilities outside of these areas would have moderate long-term beneficial effects.

#### Large Woody Debris

The continued collection of large woody debris floating in the head of Lake Chelan after large floods for erosion protection would not affect river hydrology or streamflow; however, it would reduce the amount of woody debris available in the lake ecosystem by a very small amount. This would be a negligible adverse effect on the ecology of the lake because much of the wood would be incorporated into erosion protection structures on the lakeshore as part of the PUD license. Overall, there is currently an abundance of large woody debris on the lower Stehekin River.

#### Recreational Facilities

**Lower Valley Trail:** Construction of the Lower Valley Trail would result in minor to moderate localized long-term effects on flow of the Stehekin River at the proposed foot bridge and negligible to minor adverse effects elsewhere. If bank stabilization became necessary to protect the trail bridge, impacts could increase locally.

#### Removal of Flood-Damaged Structures / Restoration

Ongoing and new removal of unoccupied flood-damaged structures would create long-term negligible to moderate benefits to water resources. Bioengineering and riparian restoration would provide added beneficial impacts by slowing floodwater and bank erosion and restoring natural floodplain processes.

### *Additional Impacts from Alternative 1*

#### Road Grade Raise

Raising the level of the road through McGregor Meadows in the floodplain with 5,600 cubic yards of fill would further obstruct floodwater and potentially augment flood damage on both sides of the road by unnaturally affecting the river hydraulics during flood stage. Over time, the road would also constrain and limit the width of the channel migration zone and it is likely that the river would migrate to the edge of the road and require extensive armoring of the road fill. Taken together, raising the roadbed and constraining the river would cause a localized long-term moderate to major adverse effect on Stehekin River floodwater levels and flow in the vicinity of McGregor Meadows (see Appendix 17).

### Erosion Protection Measures

Implementing the Stehekin Valley Road Improvement Project with installation of clusters of rip-rap and log-cribbing at the toe of the slope along 400 feet of riverbank at Wilson Creek would have moderate adverse effects on streamflow because rip-rap has a tendency to increase downstream bank erosion and to require supplementation of rock (see Table IV-8: *Alternative 1 Flood and Erosion Protection Measures*). Comparatively, the impact of this action, however, is less because this area is located on the edge of the channel migration zone.

**Table IV-8: Alternative 1 Flood and Erosion Protection Measures**

| Action | Location | Area | Impact to Streamflow |
|---|---|---|---|
| Wilson Creek clusters of rip-rap and large woody debris | Edge of CMZ | River mile 5<br>400 ft<br>(0.3 acre) | Minor localized adverse. Changes in way water moves along and downstream from the bank. |
| Maintain Company Creek Road / levee | Within floodplain / CMZ | River mile 4.6<br>400 ft<br>(0.4 acre) | Moderate to major localized adverse. Changes water movement along and downstream from bank. |

### 1995 Land Protection Plan Implementation

Ongoing actions to implement the 1995 LPP (NPS LACH 1995b) would continue to focus on protecting the scenic qualities along the Stehekin Valley Road and on removing development from the 100-year floodplain of the Stehekin River. These would continue to be the highest priorities for acquisition and exchange, but would not consider the recent changes to the Stehekin River floodplain. Changes wrought by the 1995, 2003, and 2006 floods have put several structures on the verge of being incorporated into the river. As a result, there would continue to be ongoing major adverse impacts to streamflow from the effects of development within the floodplain and channel migration zone in this alternative that would not be resolved. Combined, these effects would continue to be long-term and minor to moderate, with occasional moderate to major localized impacts when destroyed cabins, drain fields, and effluent from septic tanks are incorporated into the river. Development within the 100-year floodplain would continue to be removed, a long-term beneficial effect; however, because the 100-year floodplain has changed and some developments now threatened are not listed as high priority for acquisition, there would be minor long-term beneficial effects.

## *Impacts from Actions Common to Alternatives 2 - 5*

### Boulder Creek Logjam and Avulsion Sill

There would be no effect on floodwater elevation or floodwater depth from the location of a logjam and grade-control structure (avulsion sill) on the bank between the Stehekin River and the Boulder Creek alluvial fan. The logjam, however, would affect flood flow conditions by slowing water as it approached the nearby developed area and the sill would prevent head-cutting from forming a large channel directed toward the developed area. Because these structures would be located near the edge of the floodplain / channel migration zone, they would not prevent lateral river migration, which is limited naturally by the Boulder Creek alluvial fan.

### Milepost 8.0 Slope Stabilization

As in Alternative 1, the road would be retained at this location. In Alternatives 2 - 5, laying back the upper one-quarter to one-third of the slope and scaling rocks would allow for revegetation and gradual slope stabilization. Slope modification would not affect the river since it would be done well above the 100-year flood elevation. Actions would have short-term minor adverse and long-term moderate beneficial effects.

### Other Improvements

Modifying drainage on Thimbleberry Creek by slight elevation of the road to install new connected culverts would have short-term minor adverse effects due to construction impacts, and long-term beneficial effects on hydraulics and streamflow by improving water flow through this frequently plugged culvert. Similarly, improving drainage beneath the Stehekin Valley Road at Milepost 8.5 and at Milepost 9.2 would have short-term minor adverse effects due to construction impacts, and long-term beneficial effects under all alternatives. Slight differences in proposed actions at Milepost 8.5 in Alternatives 2 - 4 compared to Alternative 5 do not result in measurably different impacts.

### Restoration and Bioengineering

Combined restoration and bioengineering would increase riparian bank cover alongside the Stehekin River, a long-term localized minor to moderate beneficial effect on hydraulics and streamflow by restoring more natural rates of bank erosion.

Photo 31 – Destruction of private cabin and damage to upper Company Creek Road during the 2003 flood.

### *Additional Impacts from Alternatives 2 and 5*

#### Road Reroute

Constructing the reroute around McGregor Meadows and Lower Field would move the road outside the channel migration zone, away from frequent flooding and road erosion. This would create a long-term moderate to major beneficial effect that allows natural river processes, floodplain storage of floodwater, wood, and gravel, and lateral migration of the channel to occur. Additional culverts would be added for the road reroute, affecting seven intermittent side streams, but would not directly impact the Stehekin River. These would be crossed using a series of large diameter culverts. They could affect local streamflow from scouring and erosion of the road and ditches during floods, a long-term minor adverse effect.

#### McGregor Meadows Access Road

Impacts of retaining 0.8 mile of McGregor Meadows Access Road would be much less than impacts of raising this section of roadway in Alternatives 1 or 4 because the road grade would not be raised or realigned and the amount of extant road would be a shorter. On this section, road material would continue to be eroded and transported downstream as floodwaters rise and flow through this area, but the amount of gravel that could enter the river would be reduced compared to Alternatives 1 and 4, and is small compared to gravel transport on the river. As a result, there would be minor impacts (less than Alternative 1), depending on how much material was dislodged and/or needed to be replaced following future flooding. Retention of grade-control structures beneath the road between Mileposts 6.5 and 6.8 would slow cutting of new channels, a short term moderate impact to stream processes. Long-term minor to moderate beneficial effects would be contributed from restoration of the portion of this road that becomes a trail as well as from full restoration of other parts of the road.

#### Erosion Protection Measures

In addition to maintaining the Company Creek levee and existing erosion protection measures, proposed erosion protection measures and impacts are shown in Table IV-9: *Alternatives 2 and 5 Erosion Protection Measures*. The barbs, bioengineering, logjams, and grade-control structures proposed in this alternative would have varying impacts to Stehekin River flow due to their location with respect to the channel migration zone. Those on the edge of the channel migration zone would have less impact because they would not limit the ability of the river to migrate within its floodplain. Those within the channel migration zone would have greater effects because they would limit the river from occupying parts of its floodplain / channel migration zone.

Combined, effects from Alternatives 2 and 5 erosion protection measures could affect up to 2,150 feet of Stehekin River riverbank. This represents about 1.7 percent of the total on the lower Stehekin River, a minor to moderate long-term adverse effect. This would add to the 8,211 linear feet (6.5 percent) of bank currently affected in the lower 12 miles of the Stehekin River (see Table IV-10: *Cumulative Impacts of Stehekin River Shoreline Erosion Protection Measures*). The increase in bank hardening at the scale of the lower valley by implementing Alternative 2 would be considered minor to moderate.

At the reach scale, the largest impacts from Alternative 2 would be in Reach 1 (Appendix 4). Installation of barbs and a logjam at the Stehekin River mouth would represent a nine percent increase in the length of hardened banks in Reach 1, and would increase total affected

**Table IV-9: Alternatives 2 and 5 Erosion Protection Measures**

| Action | Location | Area | Impact on Streamflow |
|---|---|---|---|
| Boulder Creek logjam and avulsion sill | Edge of CMZ | River mile 1.5<br>400 ft<br>0.02 acre | Minor localized adverse. Would prevent head-cutting toward nearby developed area. |
| Stehekin River mouth barbs (3) | Within CMZ | River mile 0.6<br>600 ft<br>0.21 acre | Moderate localized adverse. Conversion of riffle habitat to pool habitat (6,000 square feet). Redirects flow from alongside bank to middle of channel. |
| Frog Island barbs (1 - 2) | Edge of CMZ | River mile 3.4<br>200 - 400 ft<br>0.07 - 0.14 acre | Minor localized adverse. Conversion of riffle habitat to pool habitat (2,000 - 4,000 square feet). Redirects flow from alongside bank to middle of channel. |
| Wilson Creek barbs (2 - 3) | Edge of CMZ | River mile 5<br>400 ft<br>0.14 acre | Minor localized adverse effects. Conversion of riffle habitat to pool habitat (4,000 - 6,000 square feet). Redirects flow from alongside bank to middle of channel. |
| Maintain Company Creek Road / levee | Within floodplain / CMZ | River mile 4.6<br>400 ft<br>(0.4 acre) | Moderate to major localized adverse. Changes water movement along and downstream from bank. |
| McGregor Meadows Grade Control Structure (Alt 5) | Within floodplain / CMZ | 1,000 linear feet<br>(0.14 acre)<br>Not within river | Negligible to minor localized adverse effects. Would reduce chances that river would flow down road. |

streambank in Reach 1 from ten to 19 percent. It is anticipated that this increase would result in a long-term moderate impact to streamflow at the reach scale because of location within the channel migration zone. Impacts would be greater if not for the restoration of 100 feet of bank at the site by removal of rip-rap, and if not for the strong backwater influence from Lake Chelan that unnaturally influences river processes.

In Reach 2, installation of rock barbs to protect the road at Frog Island would add minor to moderate long-term impacts by increasing the amount of hardened banks by five percent from the four percent currently modified at Harlequin Bridge. Impacts would be higher except that the barbs and bioengineering would be at the edge of the channel migration zone.

In Reach 3, installation of rock barbs to protect the road at Wilson Creek (Milepost 5.3) would add minor to moderate long-term impacts by increasing the amount of hardened banks by four percent from the three percent currently modified. Impacts would be higher except that the barbs and bioengineering would be located at the edge of the channel migration zone.

In Reach 4 at McGregor Meadows, the removal of the road would not result in a future need to harden the river bank to protect the road. Placement of the grade control structures beneath existing roads in Alternative 5 would not limit river migration, but would help to keep the river from flowing down the road. Therefore they accommodate floodplain utilization and have a negligible effect on streamflow.

**Table IV-10: Cumulative Impacts of Stehekin River Shoreline Erosion Protection Measures**

| | Number of Sites | Number of Structures | Feet of Shoreline* | Percentage of Shoreline Affected** |
|---|---|---|---|---|
| Shoreline currently affected by erosion protection structures | 46 | Estimated 64 (including levee, rip-rap, cabled logs and barbs) | 8,211 | 6.5% |
| Alternative 1 | 1 | Rip-rap | 400 WC | 6.8% total<br>0.3% added |
| Alternative 2 | 4 | 6 - 8 barbs<br>2 logjams<br>Removal of 100 ft rip-rap | up to 1,600<br>(100 SRM,150 BC 400 WC, –100 SRM) | 8.3% total<br>1.7% added |
| Alternative 3 | 6 | 4 barbs<br>5 logjams<br>Removal of 100 ft rip-rap | 800<br>(150 WP, 500 SRM,150 BC, 200 FI, 400 WC, –100 SRM) | 8.3% total<br>1.7% added |
| Alternative 4 | 9 | 16 - 17 barbs<br>3 logjams<br>Removal of 100 ft rip-rap | up to 3,400<br>(150 WP,100 SRM, 150 BC,–100 SRM) | 9.5% total<br>3.0% added |
| Alternative 5 (Preferred) | 4 | Same as Alternative 2 | Same as Alternative 2 | Same as Alternative 2 |
| Total | Alt 1: 47<br>Alt 2: 50<br>Alt 3: 52<br>Alt 4: 54<br>Alt 5: 50 | Alt 1:1<br>Alt 2:8 - 10<br>Alt 3:9<br>Alt 4:19 - 20<br>Alt 5: 8-10 | Alt 1: 8,611<br>Alt 2: 10,361<br>Alt 3: 10,311<br>Alt 4: 11,911<br>Alt 5: 10,361 | N/A |

*Note: Total estimated shoreline in Lake Chelan NRA (left and right bank) is 124,847 feet.*
**Key: WC = Wilson Creek, SRM= Stehekin River Mouth, BC = Boulder Creek, WP = Weaver Point, FI = Frog Island.*
***All numbers preliminary. Additional analysis has resulted in a determination that impacts could be approximately 400 feet less than the totals shown.*

## Revised Land Protection Plan

With the revision to the LPP, the focus of land acquisition and exchange would be on protecting sensitive resources and removing private development from not just the 100-year floodplain but also from within the channel migration zone. Over time, as properties are acquired or exchanged, fewer would remain in the channel migration zone. As a result, there would be long-term beneficial effects on the ability of the Stehekin River to store gravel, wood and floodwater within the channel migration zone. Because it is uncertain how many or which properties would be exchanged or acquired, the beneficial effects would be long term and minor to major.

In Alternative 2, the focus would be on federal acquisition of properties that would most affect the ability of the Stehekin River to migrate within its channel migration zone. Based on the 2010 draft LPP, there would be 12 properties in the vicinity of McGregor Meadows that require motor vehicle access via the McGregor Meadows Access Road. All of these would be high priority for acquisition or exchange in the 2010 draft LPP ranking except three that would be of medium priority because either they do not contain development or the development footprint is very small and therefore if flooding occurred, additional adverse effects would be minor.

In Alternative 5, the focus would be on federal acquisition of properties that are located in the most vulnerable areas that could be affected by Stehekin River flooding. Based on the revised 2012 LPP, there would be 17 properties in McGregor Meadows, where the river velocity and channel instability are high and flooding is most severe. In the remainder of the LPP, seven properties within the channel migration zone would be a high priority for acquisition.

There would be additional long-term minor to major adverse impacts from constructing the lower end of the Reroute Access Connector because it would be within a wetland (old river channel) within the floodplain / channel migration zone. Approximately 1.0 - 1.2 acres of this area would be affected by this portion of the road. Because no fill would be placed (except as needed to level the road), the access connector would be constructed at grade and would therefore minimize the adverse impacts of its location in a wetland.

### *Additional Impacts from Alternative 3*

Among the additional actions that would affect hydrology and streamflow of the Stehekin River in Alternative 3 would be the construction of the road reroute around only McGregor Meadows and construction of different erosion protection measures. Surfacing, culverts, and side ditches would also vary slightly under Alternative 3.

#### Road Reroute

As with the reroute in Alternative 2, constructing the 1.6-mile reroute around McGregor Meadows would relocate most of the road out of the floodplain and channel migration zone. Because the reroute would not be as long, some areas within the channel migration zone adjacent to the Lower Field would remain part of the road. This would require placement of fill within the channel migration zone, a long-term moderate adverse impact. Still, natural river processes, including lateral migration of the channel and head-cutting, would be allowed to occur in parts of McGregor Meadows. This would be an improvement over Alternative 1, but less of one than in Alternative 2. Similar to Alternative 2, the reroute would reduce the potential for future erosion management measures. As a whole, rerouting the road would enable natural processes within the Stehekin River 100-year floodplain and/or channel migration zone to continue, a long-term moderate beneficial effect to river flows.

#### McGregor Meadows Access Road Retention / Milepost 8.0 Slope Stabilization

Actions and impacts would be the same as described in Alternative 2.

#### Erosion Protection Measures

Effects from building logjams at the Stehekin River mouth, near Boulder Creek, at Frog Island, and at Wilson Creek, combined with installation of two barbs at Weaver Point and two at the Lower Field, would be long term, localized, and minor to moderate (see Table IV-11: *Alternative 3 Erosion Protection Measures*). The construction of the 150-foot logjam at Weaver Point (0.02 acre) would have negligible to minor localized adverse effects on streamflow because it would be located adjacent to the river near the edge of the channel migration zone. It would also allow floodwater to pass through the structures and would not raise the floodwater elevation.

**Table IV-11: Alternative 3 Erosion Protection Measures**

| Action | Location | Area | Impact on Streamflow |
|---|---|---|---|
| Weaver Point logjam | Edge of Channel Migration Zone (CMZ) | River mile 0<br>130 ft<br>0.12 acre | Minor localized adverse. Deflects and absorbs flow, creating slowing of water and pool and scour hole formation. |
| Weaver Point barbs (2) | Edge of CMZ | River mile 0<br>400 ft<br>0.14 acre | Minor localized adverse. Conversion of riffle habitat to pool habitat (4,000 square feet). Redirects flow from alongside bank to center of channel. |
| Stehekin River mouth logjam | Within CMZ | River mile 0.6<br>500 ft<br>0.17 acres | Minor to moderate localized adverse. Deflects and absorbs flow, creating slowing of water and pool and scour hole formation. |
| Boulder Creek logjam and avulsion sill | Edge of CMZ | River mile 1.5<br>400 ft<br>0.02 acre | Minor, localized adverse. Would prevent head-cutting toward nearby developed area. |
| Frog Island logjam | Edge of CMZ | River mile 3.4<br>200 - 400 ft<br>0.09 acre | Minor localized adverse. Deflects and absorbs flow, creating slowing of water and pool and scour hole formation. |
| Wilson Creek logjam | Edge of CMZ | River mile 5<br>400 ft<br>0.14 acre | Minor localized adverse. Deflects and absorbs flow, creating slowing of water and pool and scour hole formation. |
| Lower Field barbs (2) | Within CMZ | River mile 5.9<br>400 ft<br>0.14 acre | Moderate localized adverse. Conversion of riffle habitat to pool habitat (4,000 square feet). Redirects flow from alongside bank to center of channel. |
| Maintain Company Creek Road / levee | Within floodplain / CMZ | River mile 4.6<br>400 ft<br>(0.4 acre) | Moderate to major localized adverse. Changes water movement along and downstream from bank. |

Combined effects from adding erosion protection measures at six locations in Alternative 3 would add up to 2,100 feet of hardening to the Stehekin River riverbank. This represents about a 1.7 percent increase in the total linear feet of hardened riverbank on the lower 12 miles above Lake Chelan, a minor to moderate long-term adverse effect on hydraulics and streamflow (Table IV-10: *Cumulative Impacts of Stehekin River Shoreline Erosion Protection Measures*). This would be in addition to the 8,211 linear feet (6.5 percent) of bank currently affected in the lower valley.

At the reach scale, Alternative 3 would add 13 percent more hardened bank in Reach 1 by actions at Weaver Point and the Stehekin River mouth. This would bring the total affected area in Reach 1 to 23 percent, and would be a moderate adverse impact on streamflow and hydraulics, primarily by reducing river migration and increasing stream velocity. In Reaches 2 and 3, actions at Frog Island and Wilson Creek would affect the same five percent of the bank as under Alternative 2, and would have a minor to moderate impact on streamflow because the sites are located at the edge of the channel migration zone. In Reach 4, Alternative 3 actions at the Lower Field would add about three percent to the total linear feet of hardened banks, and would have a moderate impact since the site is within the channel migration zone.

### Revised Land Protection Plan

Actions and impacts would be the same as those described above in Alternative 2.

## *Additional Impacts from Alternative 4*

### Road Grade Raise

Action and impacts would be the same as described in Alternative 1.

### Erosion Protection Measures

Actions and impacts at Weaver Point and Lower Field would be the same as in Alternative 3; Stehekin River mouth, Boulder Creek, Frog Island, and Wilson Creek (except for an additional barb) actions would be the same as in Alternative 2. In addition, two barbs would be added near Milepost 7.0 and three near Milepost 9.2 (Table IV-12: *Alternative 4 Erosion Protection Measures*).

Effects from installation of 16 - 17 new barbs and two logjams at eight sites under Alternative 4 would affect approximately 3,500 - 3,700 feet of Stehekin River riverbank, or about three percent of the total in the lower 12 miles of the river (Table IV-10: *Cumulative Impacts of Stehekin River Shoreline Erosion Protection Measures*). This would be in addition to the 6.5 percent of bank currently affected. This level of riverbank manipulation would have a moderate to major long-term adverse effect, in part because of the number of structures, but also because five of seven sites are within the channel migration zone.

In Reach 1, bank stabilization at three sites would affect 15 percent of the total riverbank, in addition to the ten percent currently affected by bank hardening. This would represent a moderate to major impact to streamflow and hydraulics in Reach 1 because of the amount of bank that would be hardened, as well as the fact that the Weaver Point and River Mouth sites are within the channel migration zone. Impacts in Reaches 2 and 3 under this alternative would be the same as in Alternative 3. At the reach scale near McGregor Meadows, construction of rock barbs at Milepost 7 on the Stehekin Valley Road and the Lower Field would add about 6 percent more hardened banks, in addition to the 22 percent already modified in Reach 4, a moderate adverse impact on hydraulics and streamflow.

In addition, three barbs would be built near Milepost 9.2 on the Stehekin Valley Road. These would be located near the edge of the channel migration zone, and would cause a moderate impact to stream processes in this reach. There are currently four other rock barbs on private land just downstream.

### Revised Land Protection Plan Implementation

As in Alternatives 2 and 3, with the 2010 revision to the LPP, the focus of land acquisition and exchange would be on protecting sensitive resources and removing private development from the floodplain and channel migration zone. In Alternative 4, however, actions would contribute to protecting the Stehekin Valley Road in place where possible.

As in Alternatives 2 and 3, over time, as properties are acquired or exchanged, fewer would remain in the channel migration zone; however, the priorities for acquisition and exchange would be focused on obtaining those properties that helped to maintain the Stehekin Valley Road over

**Table IV-12: Alternative 4 Erosion Protection Measures**

| Action | Location | Area | Impact on Streamflow |
|---|---|---|---|
| Weaver Point logjam | Edge of CMZ | River mile 0<br>130 ft<br>0.12 ac | Minor localized adverse. Deflects and absorbs flow, creating slowing of water and pool and scour hole formation. |
| Weaver Point barbs (2) | Edge of CMZ | River mile 0<br>400 ft<br>0.14 ac | Minor localized adverse. Conversion of riffle habitat to pool habitat (4,000 sq ft). Redirects flow from alongside bank to center of channel. |
| Stehekin River mouth barbs (3) | Within CMZ | River mile 0.6<br>600 ft<br>0.21 ac | Moderate localized adverse. Conversion of riffle habitat to pool habitat (6,000 sq ft). Redirects flow from alongside bank to middle of channel. |
| Boulder Creek logjam and avulsion sill | Edge of CMZ | River mile 1.5<br>400 ft<br>0.02 acre | Minor, localized adverse. Would prevent head-cutting toward nearby developed area. |
| Frog Island barbs (1 - 2) | Edge of CMZ | River mile 3.4<br>200 - 400 ft<br>0.07 - 0.14 ac | Minor localized adverse. Conversion of riffle habitat to pool habitat (2,000 - 4,000 sq ft). Redirects flow from alongside bank to middle of channel. |
| Wilson Creek barbs (2 - 3) | Edge of CMZ | River mile 5<br>400 ft<br>0.14 ac | Same as above except 6,000 sq ft of riffle to pool habitat. |
| Lower Field barbs (2) | Within CMZ | River mile 5.9<br>400 ft<br>0.14 ac | Moderate localized adverse. Conversion of riffle habitat to pool habitat (4,000 sq ft). Redirects flow from alongside bank to center of channel. |
| Milepost 7.0 barbs (2) | Within CMZ | River mile 6.8<br>400 ft<br>0.14 ac | Same impact as above. |
| Milepost 9.2 barbs (3) | Within CMZ | River mile 7.1<br>600 ft<br>0.21 ac | Moderate localized adverse. Conversion of riffle habitat to pool habitat (6,000 sq ft). Redirects flow from alongside bank to center of channel. |
| Maintain Company Creek Road / levee | Within floodplain / CMZ | River mile 4.6<br>400 ft<br>0.4 ac | Moderate to major localized adverse. Changes water movement along and downstream from bank. |

those that were within the channel migration zone. As a result, although there would be long-term beneficial effects on the ability of the Stehekin River to migrate within its floodplain and channel migration zone, these would be fewer because most of the road would be retained in place. Because it is uncertain how many or which properties would be exchanged or acquired and whether these would benefit the channel migration zone or just the road, there could be a range of beneficial effects (minor to major).

## Measures to Avoid, Minimize, or Mitigate Impacts

- Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to water resources (including hydraulics and streamflow, water quality, wetlands, and floodplains) include:

- Locating staging and stockpiling areas away from the Stehekin River.
- Delineating staging areas to prevent incremental expansion of the staging area.
- Covering stockpiled fine-grained soil and rock near surface water and, if overwintered, with a breathable, water-repellent fabric, such as silt fence, anchored around the perimeter.
- Using temporary sediment-control devices such as filter fabric fences, sediment traps, or check dams as needed during culvert replacement.
- Identifying the area to be cleared to define the extent and clearing only those areas necessary for construction.
- Minimizing the amount of disturbed earth area and the duration of soil exposure to rainfall.
- Using bioengineering to stabilize riverbanks where erosion protection measures are employed.
- Minimizing soil disturbance, and reseeding or revegetating disturbed areas as soon as practical.
- Using available topsoil and duff from the reroute areas to rehabilitate (recreate habitat) the obliterated road segments and road shoulders where reroutes occur.
- Scarifying slopes, if necessary, to slow erosion.
- Retaining silt fencing in disturbed areas until stabilization (by reseeding or revegetation).
- Constructing temporary diversion devices such as swales, trenches, culverts, or drains to divert stormwater runoff away from disturbed areas, including exposed slopes.
- Using native duff and topsoil to cover exposed soil as soon as practical.
- Installing protective construction fencing around, adjacent to, or near wetland and/or riparian areas that are to be protected, or using other erosion protection measures to protect water resources in the project area.
- Avoiding machinery use below the wetted perimeter of water bodies where possible (work would be done from the bank).
- Using equipment excavators from the bank to place rock below the ordinary high water mark for rock barbs, to reduce the potential for introducing pollutants, including possible leaks of hydraulic fluid or other substances from heavy equipment.
- Using vegetable-based hydraulic fluid in heavy equipment.
- Limiting the duration of the instream work as much as possible.
- Timing instream work to occur at lower-flow periods (i.e., work would not occur during heavy river flows).
- Minimizing creation of impervious surface.
- Using a Storm Water Pollution Prevention Plan for construction activities to control surface runoff, reduce erosion, and prevent sedimentation from entering water bodies during construction.

- Developing and implementing a comprehensive Spill Prevention/Response Plan that complies with federal and state regulations and addresses all aspects of spill prevention, notification, emergency spill response strategies for spills occurring on land and water, reporting requirements, monitoring requirements, personnel responsibilities, response equipment type and location, and drills and training requirements.
- Use work area isolation techniques when water is present in adjacent streams (not the Stehekin River itself).

**Prevention of Fuel Spills:** The following BMPs to control adverse impacts of fuel spills would also be used:

- Refueling activities would be done at least 100 feet from the river and its tributaries or other surface water.
- Areas where refueling or maintenance of equipment would occur would be identified and would have containment devices such as temporary earth berms.
- Absorbent pads would be available to clean up spills.
- Restrictions on the location of fueling sites, requirements for spill containment, and other measures to safeguard aquatic and terrestrial habitat from construction-related contaminants would be identified.

## Cumulative Impacts

Over time, there have been a series of actions that have affected hydraulics and streamflow, including development and bank stabilization within the floodplain and channel migration zone. This includes existing hardened surfaces, such as roads and buildings, as well as the creation of Lake Chelan Dam. All alternatives would add to these impacts by increasing the number of control structures and continuing the long-term trend toward constraining the lower reaches of the Stehekin River (where flow is already affected by the presence of the dam and erosion protection measures at 46 sites). Depending on the alternative, implementation would result in additional cumulative minor to moderate long-term adverse impacts by preventing the Stehekin River from moving within parts of its channel migration zone. There would be no changes to side channels or tributaries entering the Stehekin River. Large sections of the channel migration zone on the right bank of the river below and above Harlequin Bridge would be available to store floodwater, large wood, and gravel, and for future river migration.

Over time, instream structures, including rock barbs, rip-rap, and other channel modifications, have increased. Past projects have resulted in a total of 30 barbs and up to 50 other erosion protection structures (i.e., cabled logs, rip-rap, or a combination of structures) at 46 sites on the lower Stehekin River (Table IV-13: *Lower Stehekin River Shoreline Affected by Erosion Protection or Flood-Control Structures*). Most of these are concentrated in sediment deposition zones at McGregor Meadows and at the Stehekin River mouth (Figure III-9). As a result, large parts of the river and floodplain between these areas remain relatively unaltered.

Overall, Alternative 4 proposes the most erosion protection measures and would add major adverse cumulative effects on streamflow and hydraulics (see Table IV-10: *Cumulative Impacts of Stehekin River Shoreline Erosion Protection Measures*). In contrast, the reroute in Alternative 3 would allow for channel migration in McGregor Meadows, whereas it would prevent it alongside

**Table IV-13: Lower Stehekin River Shoreline Affected by Erosion Protection or Flood-Control Structures**

| Erosion Protection Structures | 1993 | 2001 - 2002 | 2009 |
|---|---|---|---|
| Number of Sites | 28 | 35 (with 80 structures) | 46[a] |
| Length | 4,861 ft | 6,965 ft | 8,211 ft[b] |
| Number of Barbs | 0 | 10 | 30[c] |
| Percentage of Bank | 3.9 | 5.6 | 6.5 |

*Note: Total shoreline length (estimated left and right banks) is 124,847 feet.*
*[a]Sites added since 2001 - 2002 are upper Company Creek Road (2007), Courtney Ranch (2007), Scutt (2007), and Leader Levee (2008).*
*[b]Added 427 feet to upper Company Creek Road, 427 feet to Milepost 8.0, and 328 feet to Leader.*
*[c]NPS added six barbs at Milepost 8.0 (1993, 2008), ten barbs at Company Creek Road (1997, 2007), and four barbs near the orchard (1999). Private owners added two barbs on Leader (1997), four barbs at Stehekin Valley Ranch (2007), one barb at Company Creek Road (1997), and three barbs near the River Resort Road (1997).*

the Lower Field (moderate impact). Similarly, Alternatives 2 and 5 would contribute the least to cumulative impacts on streamflow and hydraulics by relocating the road away from both of these areas and by proposing erosion protection measures at the fewest sites compared to Alternatives 3 and 4 (and eventually Alternative 1). Alternative 1 would add additional rip-rap at one site on the lower river (Wilson Creek). Alternatives 2 and 5 would add six to eight rock barbs, two logjams, and an avulsion sill at four sites. Alternative 3 would add four rock barbs, five logjams, and an avulsion sill at six sites, and Alternative 4 would add 16 - 17 rock barbs, three logjams, and an avulsion sill at eight sites on the lower Stehekin River. Together, these structures would cause changes in streamflow that would be measurable and would have consequences on channel-forming processes and downstream erosion processes. Therefore, the cumulative adverse impacts under all alternatives would be moderate and long term, however, these impacts would likely be greatest, in sequence, under Alternatives 4, 1, 3, and 2 / 5.

The greatest cumulative adverse effects would occur in McGregor Meadows (Reach 4) from Alternatives 1 and 4. In the McGregor Meadows deposition zone, 22 percent of the streambanks are currently modified, and include ten NPS and three private rock barbs. Eleven of the barbs are along the Company Creek Road on the other side of the river from McGregor Meadows. Combined, these structures restrict movement of the Stehekin River to the west into a large gravel terrace that stands above the floodplain, and limit the introduction of gravel into this reach. They do not increase floodwater elevations on the other side of the river. There are also multiple grade control structures in the floodplain on both sides of the river, built mainly on private land through cooperative public-private projects.

Alternatives 4 (and eventually Alternative 1) would increase the modified bank amount by six percent in Reach 4. More importantly, these alternatives would further restrict the ability of the Stehekin River to occupy the lowest part of its floodplain (east of the existing road into McGregor Meadows). Ultimately, movement of the river to an elevated road through this area would require additional rock barbs and other erosion protection measures, and could further increase the amount of modified stream bank in this reach to 50 percent or more. Although Alternative 1 would be limited in its current contribution to cumulative effects, over time it would likely result in a contribution to cumulative effects, similar to Alternative 4 by inhibiting the Stehekin River from occupying the lowest parts of its channel migration zone. Alternatives 2, 3, and 5 would not add to cumulative effects in McGregor Meadows.

At the river mouth deposition zone (Reach 1) about ten percent of the stream banks have been modified, mostly on the left (east) bank of the river at its juncture with Lake Chelan. Approximately 60 percent of the erosion protection measures are on private land, and include two rock barbs and 600 feet of rip rap. Alternative 4 would increase this amount by 15 percent (25 percent total) by adding rock barbs to extend the existing private erosion protection upstream on the east bank, and adding rock barbs to the opposite bank downstream at Weaver Point. Alternatives 2 and 5 would increase the amount of hardened bank by nine percent (19 percent total).

Combined, these actions will continue to restrict the migration of the river to the east, toward a densely develop area. However, the river's activity in this reach is already strongly influenced by the rise and fall of Lake Chelan, and the right (west) bank of the river is undeveloped and can accommodate future river migration.

Long-term moderate beneficial effects would be contributed under all alternatives from replacement and relocation of the housing and maintenance areas. This would allow water to flow more freely through the area in Reach 3 during floods into a large expanse of undeveloped floodplain below Harlequin Campground.

## Conclusion

Effects of erosion protection structures are summarized in Table IV-10: *Cumulative Impacts of Stehekin River Shoreline Erosion Protection Measures*. In Alternative 1, one structure would be located within the floodplain / channel migration zone and one outside of it. Under Alternatives 2 and 5, one new erosion management site would be within the channel migration zone and three outside of it. In Alternative 3, there would be three new sites inside and four outside the channel migration zone. If implemented, Alternative 4 would have five new sites of bank modification inside and five outside the channel migration zone. In addition, in Alternative 5, a portion of the Reroute Access Connector would be constructed within an old river channel which is a wetland within the floodplain / channel migration zone. There would be minor to moderate beneficial effects from riparian restoration and bioengineering in all alternatives.

Total impervious areas could be up to five to eight acres for the maintenance and housing areas plus additional area for the rehabilitated road (Alternatives 1 and 4), or for the rehabilitated/rerouted road (Alternatives 2, 3 and 5). New impervious surfaces could also cover an additional five to eight acres of the 37 acres available for exchange in the 1995 LPP in Alternative 1, and approximately seven of the 24 acres available for exchange in Alternatives 2 - 4 as well as seven of the 29 acres in Alternative 5. Impervious surfaces would result in faster runoff. In Alternatives 2, 3 and 5, relocating the road away from the eroding banks would have a moderate long-term beneficial effect because it would diminish the need for additional erosion protection structures and allow natural river processes to predominate in more areas.

Alternatives 2 would have minor to moderate adverse effects on hydraulics / streamflow, followed by Alternatives 3 and 5 (moderate adverse), and finally Alternatives 4 and 1 (major). All alternatives would result in long-term moderate beneficial effects from relocation of the maintenance area. Ultimately, Alternative 1 would likely have greater adverse effects (moderate to major) on hydraulics / streamflow in the future (similar to Alternative 4) because of the long-term need to continue to maintain the road with additional erosion protection measures.

# 6. Water Quality Impacts

## Water Quality Methodology

The aquatic resources in the Stehekin River valley represent high quality conditions and are considered Tier II waters under State of Washington implementation of the Clean Water Act. As a result, any action meeting specific criteria and with potential to cause measurable changes in water quality to these water bodies must undergo a Tier II analysis. This analysis consists of an evaluation of whether or not the degradation of water quality that would result from a proposed action would be both necessary and in the overriding public interest. As Tier II waters, measurable change constituting impacts to water quality, is based on best professional judgment and projected changes in the following measurable values:

- Temperature increase of 0.3°C or greater
- Dissolved oxygen decrease of 0.2 mg/L or greater
- Bacteria level increase of 2 cfu/100 mL or greater
- pH change of 0.1 units or greater
- Turbidity increase of 0.5 NTU or greater
- Any detectable increase in the concentration of a toxic or radioactive substance.

**Type of Impact:** The following characteristics of water would be affected by the proposed actions described in the alternatives: temperature, dissolved oxygen, suspended sediment, nutrients, and toxic pollutants. The concentrations and interactions of these elements can affect the health and fecundity of individual organisms, alter the structure of biological communities, and impact natural ecosystem processes.

**Intensity of Impact:**

- **Negligible:** Chemical, physical, or biological effects would not be detectable, would be well below water quality standards or criteria, and would be within historic or desired water quality conditions.
- **Minor:** Chemical, physical, or biological effects would be detectable, but would be well within water quality standards or criteria and within historical or desired water quality conditions.
- **Moderate:** Chemical, physical, or biological effects would be detectable but would be within water quality standards or criteria; however, historical baseline or desired water quality conditions would be temporarily lie outside of historical or desired conditions.
- **Major:** Chemical, physical, or biological effects would be detectable and would be frequently outside historical baseline or desired water quality conditions. Chemical, physical, or biological water quality standards or criteria would be measured outside of the Tier II thresholds.

## Water Quality Impacts

### *Impacts of Actions Common to Alternatives 1 - 5*

Most of the same actions that would affect hydraulics and streamflow, vegetation, and soils would also potentially affect water quality from the introduction of sediments and pollutants (e.g., from septic systems). Multiple recent large floods have increased scouring of the Stehekin Valley Road and have contributed to a relatively small amount of road gravel being moved into riparian areas downstream, however, most of the sediment in the river channel is being produced naturally by tributary streams and by bank erosion upstream and is not a direct result of human activity. These events have also led to the proliferation of erosion protection structures.

#### Ongoing Maintenance and Operations

Existing impacts on water resources would continue. The ongoing effects of development located in the channel migration zone would continue to have negligible to moderate long-term adverse effects by continuing to alter the passage and quality of overland water flow through these areas. These development effects include ongoing maintenance and repair of the Stehekin Valley Road and the Company Creek Road, including gravel inputs for the Company Creek Road (under all alternatives), which may erode during stormwater runoff or floods. The gravel would likely enter creeks and the Stehekin River and affect water quality by contributing oil and other hydrocarbons.

Contaminants in stormwater from hardened or surfaced and gravel roads can also affect several water quality conditions, including the amount of dissolved oxygen in the water, turbidity, and pH, which can adversely affect biological resources. Traffic on the Stehekin Valley Road is relatively low, the road is well separated from the river in most places, and there is a relatively high volume of water in the river; therefore, it is likely that these contaminants would have long-term but negligible to minor adverse impacts.

Gravel roads generate dust during dry periods and the dust coats vegetation next to the roads and washes away into the surrounding area, including the river, during storms. In Alternatives 1 - 5, overall impacts related to the use of the roads and procurement of gravel would be fewer since more areas of the Stehekin Valley Road would be surfaced and raised or relocated. Use of the unsurfaced Company Creek Road (all alternatives) and McGregor Meadows Access Road (Alternatives 2, 3 and 5) and the Reroute Access Connector (Alternative 5), however, would continue to contribute a small amount of road fill during flooding.

Localized flooding due to undersized, damaged, or clogged culverts and poor drainage conditions under on the Company Creek Road or sections of the Stehekin Valley Road not proposed for rehabilitation would also continue to cause sedimentation. Poorly located or plugged culverts would continue to cause rapid erosion of road fill during floods and contribute to road failure resulting in disturbed soil being carried into nearby streams, which could adversely impact water quality. Adverse impacts would include minor to moderate short-term and long-term minor impacts, since most material is sand and gravel, not silt or clay and because culverts in poor condition under Alternatives 1-5 in the rehabilitation sections of the Stehekin Valley Road would be replaced or their inlets / outlets repaired as part of the road rehabilitation project under all alternatives (see below).

### Road Rehabilitation

Because less gravel would be needed over time from the Company Creek Pit due to surfacing of the Stehekin Valley Road, there would be less dust generated both from transport of this material and from driving over the portion of the road that is currently unpaved.

**Surfacing:** This would affect water quality by contributing faster runoff of dirt and oil and other roadway contaminants, generated from vehicle travel over hardened surfaces, into the Stehekin River. These would cause short-term negligible to minor effects on water quality. Flushes of runoff during storms would also contribute to long-term minor to moderate adverse effects to the extent that these pollutants persisted in the river and/or Lake Chelan. Petroleum products and metals would be deposited onto road and parking lot surfaces from vehicles and picked up during rain, snowmelt, and carried into water sources. These contaminants would also indirectly affect water resources through infiltration into groundwater over time.

**Culverts:** Most culverts affected by the proposed project do not carry perennial or intermittent streams: rather, they are used to convey rain and snowmelt and are known as "ditch relief" culverts. Coupled with work along the Stehekin River, at Wilson Creek and Thimbleberry Creek, and work in water to place barbs or logjams (Alternatives 2 - 5), work on existing culverts and installation of new and replacement culverts would have the potential to contribute sediment directly and indirectly to the Stehekin River. Adherence to the use of required best management practices would result in negligible to moderate short-term and negligible to minor localized effects on water quality.

**Construction:** Actions and impacts from construction, including excavation, grading, importing fill, loss of vegetation, and potential spills, would occur from rehabilitation of the road and from the implementation of erosion protection measures (different measures, but similar impacts, under all alternatives). Impacts would also be associated with construction of the maintenance and housing areas and construction of the Lower Valley Trail. Despite required best management practices to prevent them, construction activities such as refueling and use of heavy equipment may result in spills of oil or fuel that could enter the river during stormwater runoff. Accidental release of hydraulic fluid, diesel fuel, and other petroleum products during construction is also possible if required best management practices fail. Small amounts of these contaminants could also enter the river in stormwater runoff, causing short-term negligible to moderate adverse and long-term negligible to minor adverse effects to water quality.

Stockpiled earth and other materials in staging areas within the project area are also susceptible to erosion from stormwater. Potential erosion-generated sediment associated with construction is likely to be undetectable because most of the work would not occur close to surface water, required best management practices can largely control erosion and sedimentation, work would occur primarily during the dry time of year, and much of the soil is comprised of sand and gravel, which would not easily erode.

Proposed project actions under the alternatives, including the development of the new maintenance and housing area (grading, construction, circulation, and parking) (five to eight acres) and the rehabilitation of up to 4.9 miles of roadway, would have the potential to affect water quality. Impacts would occur from excavation (which would loosen soil materials); stockpiling of topsoil and other materials (which could be affected by runoff during seasonal rain or snowmelt); vegetation disturbance and modifications (removal, grubbing and flush-cutting, which would also open up new areas to erosive action by water once soil was disturbed); and drainage improvements such as installation of new culverts (which would affect wet soils and would loosen soil materials and temporarily subject them to erosion).

Combined, short-term effects on water quality would be minor and localized in the area of improvements and would depend on weather conditions during construction. Most construction sites are flat and located some distance from the river or perennial streams, and most construction activities would occur later in summer, after snowmelt. The new maintenance area would be located on young, gravelly soils. The removal of the fuel storage and maintenance facility from the 100- and 500-year floodplains would have a long-term moderate to major beneficial impact on improving water quality. Moderate-term impacts would be related to the period of time between disturbance and rehabilitation or restoration and would be minimal from road rehabilitation. Overall effects on water quality during construction would be minor and localized and would depend on weather conditions during construction.

#### Recreational Facilities

**Lower Valley Trail:** Construction of the Lower Valley Trail would result in the same kinds of impacts as described above for road rehabilitation. Trail impacts, however, would be more localized and much less extensive. There could be short- and long-term minor localized impacts on water quality, depending on soil moisture, weather conditions, and the effectiveness of BMPs and mitigation measures. Because most actions would occur in areas removed from Stehekin River, during the summer dry season, they would likely result in both fewer and indirect impacts compared to those associated with road rehabilitation.

#### Removal of Flood-Affected Structures

Because removal would be conducted during dry periods when the structures themselves were out of the water (post-flooding), actions would have a limited effect on water quality. If, however, additional flooding occurred before site restoration had taken place, this action could contribute short-term minor to moderate adverse effects. Because these actions would be undertaken intermittently as structures were affected, they would occur spaced widely in time (and usually distance) from one another and would also have moderate to major beneficial effects by removing potential sources of contaminants from the channel migration zone.

#### Maintenance Facility Replacement and Relocation

Relocation of the NPS maintenance facility would have a major beneficial impact on water quality in the river by removal of hazardous material stored at the site, including gasoline, diesel, paints, oils, and solvents. It is possible that some soil contamination is present in the vicinity of the former maintenance area, which would need to be remediated.

### *Additional Impacts from Alternative 1*

#### Road Grade Raise

Retaining the Stehekin Valley Road in its current alignment within the floodplain including the addition of 5,600 cubic yards of fill material required to raise the height of the road, could affect water quality during construction and flooding. Raising the height of the road in some sections and realigning other sections through McGregor Meadows would result in short-term negligible to minor adverse impacts from construction and could result in erosion of road fill by

**Table IV-14: Rehabilitation Actions Alternatives 1 - 5**

| Alternative | Number of Pullouts / Acres Affected | Number of Culverts* | Barbs / Bioengineering | Logjams | Other Road Stabilization Measures |
|---|---|---|---|---|---|
| Alternative 1 | 5 existing<br>Approximately 20 new<br>0.28 acres | Replace existing culverts with minimum 24-inch diameter CMPs and install additional culverts to provide 500 foot minimum spacing along the reconstructed road, and increase culvert sizes where existing culverts are undersized. | Existing | Existing | Wilson Creek |
| Alternatives 2 and 5 (Preferred) | Up to 30 new<br>0.34 acres | Construct new culverts spaced at 300 - 350 feet on the reroute. Replace existing culverts with larger 60-inch culverts at Wilson and Thimbleberry Creeks. Install box culverts or low water crossings at MP 8.5 and 9.2. | Stehekin River mouth<br>Frog Island<br>Wilson Creek | Stehekin River mouth<br>Boulder Creek | Wilson Creek<br>Milepost 8.0 |
| Alternative 3 | Up to 23 new<br>0.30 acres | Same as above, except slightly fewer culverts on the reroute | Weaver Point<br>Lower Field | Weaver Point<br>Stehekin River mouth<br>Boulder Creek<br>Frog Island<br>Wilson Creek | Same as Alternative 2 |
| Alternative 4 | Same as Alternative 1 | Same as Alternative 1, except replace existing culverts with larger 60-inch culverts at Wilson and Thimbleberry Creeks, and install low water crossings at MP 8.5 and 9.2. | Weaver Point<br>Stehekin mouth<br>Frog Island<br>Wilson Creek<br>Lower Field<br>Milepost 7.0<br>Milepost 9.2 | Weaver Point<br>Stehekin River mouth<br>Boulder Creek | Same as Alternative 2 |

**Affecting an estimated 70 - 350 square feet each.*

floodwaters, a long-term moderate adverse effect on water quality because fill could be released into the river during a major flood.

### Erosion Protection Measures

**Milepost 5.3 (Wilson Creek):** Actions to install rip-rap clusters with large wood at Wilson Creek and to lower the road and move it laterally away from the river would have both short-term minor localized adverse effects on water quality from the potential for sedimentation during construction, especially related to accessing the toe of the slope where work would occur, and minor long-term beneficial effects from stabilizing this eroding slope, thereby minimizing the potential for sedimentation from slope failure.

### Large Woody Debris

Obtaining large woody debris from the head of Lake Chelan after floods in spring and fall would have minimal effect on sedimentation and water quality, because only floating logs would be procured using a barge floating on the lake.

### 1995 Land Protection Plan Implementation

There would continue to be periodic impacts from flooding of buildings and structures, including septic system drain fields, and from unchanged implementation of the existing priorities for acquisition and exchange from the 1995 LPP (NPS LACH 1995b). Depending on the degree to which implementation of the 1995 LPP focused on removal of structures from the 100-year floodplain of the Stehekin River, there would be long-term minor to moderate beneficial impacts on water quality from the removal of both buildings and their accompanying infrastructure. Compared to Alternatives 2 - 5, in Alternative 1 fewer buildings and structures would be removed from the channel migration zone because these would not be high priority for acquisition or exchange. As a result, there would be increasingly adverse effects as the river and flood channels encroached on developments, particularly in McGregor Meadows. Because these effects would primarily be associated with flooding and not with day-to-day actions, potential effects on water quality would be long-term, and would range from negligible to moderate, depending on the severity of flooding.

## *Impacts from Actions Common to Alternatives 2 - 5*

### Erosion Protection Measures

Rock barb construction, bioengineering and engineered logjams which would occur in water or seasonally saturated soils to locate barbs would have the potential to contribute a moderate localized short-term adverse impact on water quality. Overall, adverse impacts would primarily be short term and minor in Alternatives 1, 2 and 5, with slightly greater impacts associated with Alternative 3 because of more bank excavation associated with more logjams. Alternatives 1, 2, 3 and 5 would have fewer impacts than Alternative 4 (moderate) because there would be fewer erosion protection measures overall. Anticipated future impacts in Alternative 1, however, could eventually rise to equal or exceed those in Alternative 4.

Similarly, there would be minor to moderate impacts from constructing engineered logjams. Logjams require greater excavation than do barbs to ensure that they remain anchored to the bank. Further, much of this excavation would be within the wetted perimeter of the Stehekin

River. Two logjams would be constructed in Alternatives 2 and 5, and five logjams would be constructed in Alternative 3, with impacts greater in Alternative 3 because of the much larger size of the logjam near the mouth of the Stehekin River combined with the moderately-sized logjam at Wilson Creek and the small logjam at Frog Island. Alternative 4 would have three logjams, two small ones at Weaver Point and the river mouth and a larger one at Boulder Creek.

Installation of barbs and logjams would result in retention of key portions of the Stehekin Valley Road, thus contributing to long-term beneficial impacts on water quality by decreasing slope instability adjacent to the river at Wilson Creek and Milepost 8.0, among other areas.

**Milepost 3.8 (Frog Island), Milepost 5.3 (Wilson Creek), Milepost 8.0:** Where reroutes would not occur, there would be a long-term potential for catastrophic flooding to erode portions of the road in these areas, an effect that would be partially precluded by the installation of bioengineering, barbs or logjams. Therefore, there would be long-term negligible to moderate beneficial effects, coupled with short-term localized minor to moderate adverse effects if erosion from flooding occurred before bank stabilization measures were installed.

**Milepost 9.2:** Construction of a parking area and grade raise length of 300 feet would have minor localized adverse impacts on water quality since this area is not within the floodplain.

### Large Woody Debris

Under Alternatives 2 - 4, because targeted logs would be taken from the tops of some logjams, impacts would primarily be related to gaining access to the jams and would be implemented only if adverse impacts were negligible to minor short-term and localized. These impacts could include future sedimentation during runoff from tracked heavy equipment disturbing vegetation. Access to logjams would be only from the tops above the high water mark, in a way that would not affect the stability of the jam or conditions downstream. In Alternative 4, wood would be obtained from a larger area; therefore, it is likely that impacts would be greater than in Alternative 2 and 3, but to meet mitigation requirements, they would not exceed localized minor adverse impacts from this access.

### Recreational Facilities

**Campgrounds and River Access Point:** Construction of the new campgrounds and river access point would have the potential to contribute negligible to minor localized adverse impacts on water quality, primarily from long-term impacts related to vegetation loss and short-term impacts related to runoff from disturbed areas. Impacts from the river access point, however, would not occur in Alternative 3.

### Restoration and Bioengineering

Riparian restoration and/or bioengineering associated with rock barbs and logjams would result in long-term negligible to moderate beneficial impacts on water quality from the ability of vegetation to retain soils along these eroding banks. There would be greater beneficial effects in Alternatives 2 / 5, 3, and 4 and fewer in Alternative 1.

### *Additional Impacts from Alternative 2*

#### Road Reroute

The loss of vegetation from 1.8 miles of new roadway (3.21 acres) plus the clearing needed to construct this road (approximately 13 acres) could result in short- and long-term minor to moderate adverse impacts on water quality from runoff before restoration of vegetation occurred. Most of the reroute would be distant from the river or wetlands, however, there are seven intermittent streams crossed by the new route. During and immediately following construction and until stabilization of potential impacts has occurred, BMPs, including sediment barriers and soil cover, would remain in place and would be regularly monitored and maintained.

#### Shooting Range

There is a possibility that soil contamination from lead bullets and shot is present in the vicinity of the former shooting range, which would need to be remediated by removal of soil. If contamination is found during the proposed project, it would be remediated, a long-term beneficial effect on water quality.

#### 2010 Revised Land Protection Plan

Changing the priorities in the 1995 LPP would result in the potential for long-term moderate to major beneficial impacts on water quality by removing buildings and structures, including septic system drain fields, from both the floodplain and channel migration zone of the Stehekin River. Depending on the degree to which priorities allowed for this removal to occur, there would also be a potential for short-term moderate to major adverse effects from buildings and structures that remained and were affected by future flooding.

### *Additional Impacts from Alternative 3*

Actions and impacts would be the same as in Alternative 2 for implementation of the revised 2010 LPP, Milepost 8.0 and 9.2, large woody debris, and similar for erosion protection measures but with a different array of logjams and rock barbs at two additional locations. There would also be similar impacts from additional barbs at Lower Field (because the road would not be rerouted in this section).

#### Road Reroute

As in Alternative 2, the loss of vegetation from 1.6 miles of new roadway (about 3.4 acres) plus the clearing needed to construct the reroute (approximately 13 acres) would result in short- and long-term minor impacts on water quality from runoff before restoration of vegetation occurred. During construction and until stabilization, BMPs (including sediment barriers) would remain in place. Erosion protection measures would reduce impacts, but impacts would also be greater than in Alternatives 2 and 5 because of not rerouting the road adjacent to the Lower Field.

### *Additional Impacts from Alternative 4*

Actions and impacts would be the same as in Alternatives 2 and 5 for Milepost 8.0 and 9.2, and similar to Alternative 3 for erosion protection measures. These include logjams at Weaver Point, near the river mouth, and Boulder Creek, as well as additional barbs at Milepost 7.0 and 9.2.

Impacts associated with the road grade raise / realignment would be similar to Alternative 1 from the addition of approximately 5,600 cubic yards of fill.

#### Large Woody Debris

Impacts would be similar to Alternatives 2, 3 and 5, but because there would be additional areas to procure logs from, there would be more areas of impact.

#### 2010 Land Protection Plan Revision

A revised LPP with different priorities than in Alternatives 2 and 3 would also result in removal of buildings and structures from the floodplain and channel migration zone of the Stehekin River; however, because the focus in this alternative would be on retaining the current development pattern, these impacts would be more beneficial in Alternatives 2, 3 and 5 than in Alternative 4. Nonetheless, Alternative 4 would have long-term minor to moderate beneficial effects from the removal of some buildings and structures, and adverse impacts would be similar to Alternatives 2 and 3.

### *Additional Impacts from Alternative 5*

#### Reroute Access Connector

Removal of vegetation and construction of the connector would result in impacts to 1.0 - 1.2 acres of wetland within the floodplain / channel migration zone. Because the road would be at grade and could be affected by future flooding, the unpaved surface could wash away, causing minor to moderate short-term localized adverse impacts on water quality.

#### 2012 Land Protection Plan Revision

Effects would be similar to those noted above under Alternative 2, however slightly more lands would be available for exchange outside the channel migration zone, and priorities would be focused on the areas most vulnerable to the river in McGregor Meadows. Because of this focus, long-term beneficial effects could occur sooner.

## Measures to Avoid, Minimize, or Mitigate Impacts

See "Measures to Avoid, Minimize, or Mitigate Impacts" in "Hydraulics and Streamflow Impacts."

## Cumulative Impacts

Past, present, and future actions may have affected, or will affect, water quality in the Stehekin River and Lake Chelan. For example, construction of the original roads and subsequent maintenance to retain and reconstruct them has provided a minor source of sand and gravel to the river system, which has a mean annual gravel transport rate of approximately 5,600 cubic yards (Appendix 16). Flooding has also washed away segments of the road and resulted in unknown impacts from turbidity during floods. Since most of the road fill is coarse-grained, it is likely that it is deposited near the head of the lake and does not affect water clarify or quality further down lake. This adverse water quality impact is also temporary, and because the river already carries a high volume of sediment during flood events, the incremental increase has been small due to the amount of material washed into the river compared to the size of the watershed and the volume of water and sediment it produces. Most of the sediment in the river channel is being produced naturally by bank erosion, debris flows, and landslides upstream (in wilderness) during flood events and is not a direct result of past or present human activity.

Other visitor uses and facilities in Lake Chelan NRA, including within the project area also have contributed to sediment and pollutants, including from litter, oil, and other contaminants that enter drainages and affect water quality. Septic systems are a primary source of threats to water quality from private development, which is expected to continue to grow slowly in the next few decades. The combination of planned restoration and development projects (e.g., addition of new visitor service facilities and restoration of old roads and campgrounds or building sites) would also continue to occur and would contribute a mix of beneficial and adverse impacts to water quality. Because impacts to water quality are primarily short-term and localized overall cumulative effects on Lake Chelan NRA waters have been minor to moderate. These have been coupled with cumulative beneficial impacts from removing facilities from floodplains and slowing erosion of riverbanks that support the road through implementation of erosion protection measures. Nonhuman-caused factors, such as natural erosion of exposed soils, would also continue to have negligible to minor cumulative adverse effects on water quality.

Alternatives 1 and 4 would initially contribute minor localized cumulative impacts, primarily from construction of the new maintenance area and housing. If the fill placed in the McGregor Meadows section of roadway were to be eroded by future flooding, if flooding of septic systems occurred, or if inputs additional sections of the roadway failed, there would continue to minor to moderate contributions to cumulative effects. These would be fewer in Alternative 4 than in Alternative 1 due to the additional erosion protection measures that would be implemented in Alternative 4. Negligible to minor cumulative beneficial effects from road rehabilitation actions that improved drainage conditions, reducing the likelihood of road failure, would also occur. Impacts of past, present, and future actions, combined with the impacts of Alternatives 1 or 4, could continue to result in minor to moderate cumulative adverse effects on water quality.

Alternatives 2 and 3 could also contribute minor short-term cumulative impacts from construction of the maintenance and housing areas combined with minor cumulative impacts from construction of the reroutes. Additional cumulative impacts could result in all alternatives if erosion and sedimentation BMPs or mitigation measures failed during or following construction. Overall, water quality would benefit as a result of past and reasonably foreseeable actions in Lake Chelan NRA as a result of the proposed plan, especially through the relocation of some administrative facilities (including the road in Alternatives 2, 3 and 5). Because the alternatives, especially Alternatives 2 - 5 would result in long-term beneficial effects on water quality in the river, there would be a net improvement to water quality in Lake Chelan. The most critical impacts to Lake Chelan water quality would continue to be from the superfund site in the Railroad Creek Valley and from pesticides used on orchards, vineyards, and lawns at the south end of the lake.

Revision of the LPP, particularly in Alternatives 2 and 3 and to a slightly lesser degree in Alternative 5, would contribute a moderate to major beneficial effects on water quality by creating the framework for removal of private cabins and drain fields within the floodplain / channel migration zone. Combined with relocating hazardous-materials storage and heavy equipment from the floodplain in all alternatives (with the relocation of the maintenance area), the alternatives would contribute localized moderate to major cumulative beneficial effects on water quality. When the impacts of past, present and future actions were added to the impacts of Alternatives 1 or 4, there would be minor to moderate cumulative adverse effects and minor cumulative beneficial effects. Alternatives 2, 3 and 5 would have minor cumulative adverse effects and minor to moderate cumulative beneficial effects.

## Conclusion

Excavation, grading, importing fill, loss of vegetation, and the addition of impervious surfacing or developed areas would be present in all alternatives and would affect or have the potential to affect local water quality. Alternatives 1 and 4 would result in the greatest amount of additional fill placed in the floodplain, therefore the greatest potential for short- and long-term adverse impacts. The amount of excavation and vegetation loss would also be lower in Alternatives 1 and 4 than in other alternatives due to the retention of the existing road in both alternatives. As noted in other sections, however, it is likely that erosion protection measures in Alternative 1 would eventually need to be similar to those in Alternative 4.

Restoration of degraded riparian areas would be lowest in Alternative 1, resulting only from the removal of the former maintenance area. Alternatives 2 - 5, however, would include additional riparian restoration, road obliteration, and bioengineering associated with installation of barbs and logjams. Additional beneficial impacts would result from road surfacing. Alternative 1 would have the potential for short-term minor to moderate adverse impacts and localized minor long-term beneficial effects. Alternative 4, in comparison, would have short-term moderate adverse impacts; however, beneficial effects would be greater and more widespread than in Alternative 1.

Alternatives 2, 3 and 5 would expose the greatest amount of undisturbed soil to runoff because of the reroute and would also result in the greatest vegetation loss, from excavation, and fill. These alternatives would use the least amount of imported fill since most fill would come from within the reroute. Compared to Alternative 1, there would be slightly more impervious surfaces and developed areas from surfacing of the reroute sections.

Acres of direct and indirect impacts and short-term impacts would also be greater in Alternatives 2 and 3 because of the reroutes. Removing the road from the floodplain in Alternatives 2, 3 and 5, however, would be a moderate to major long-term beneficial effect on water quality. Slightly more restoration and bioengineering would occur in Alternatives 2 and 5 than in Alternative 3. These alternatives would have more restoration and bioengineering overall than Alternative 1. Alternative 4 would have more bioengineering and less restoration. Similar to Alternatives 1 and 4, there would be both adverse and beneficial effects from surfacing. Both adverse and beneficial effects would be greater than in Alternatives 1 and 4 because of the greater amount of surfacing (causing more impervious surfacing and less dust and repeated transport of loads of gravel for the roadway). Alternatives 2, 3 and 5 would have major long-term benefits on water quality because of the Land Protection Plan revisions, relocation of the road, and relocation of the maintenance area. Alternatives 1 and 4 provide only the benefit of the maintenance area relocation.

Alternatives 1 - 4 would have moderate to major beneficial impacts on water quality from moving the maintenance area out of the floodplain / channel migration zone. Alternatives 2 - 5 would also have moderate to major localized beneficial effects from Land Protection Plan actions.
All alternatives (1 - 5) would have short-term negligible to moderate adverse impacts from construction, with increasing impacts in Alternatives 2, 5, 3 and 4 from construction of barbs and logjams; 2, 3 and 5 from construction of the reroutes; and Alternative 5 from construction of the

Reroute Access Connector. Alternatives 1 and 4 would also have potential long-term moderate to major localized adverse effects from adding fill in McGregor Meadows if it was eroded during future flooding.

# 7. Wetlands Impacts

## Wetlands Methodology

This analysis considers whether proposed actions would breach applicable federal laws, regulations, or executive orders. For the action alternatives, in addition to overall qualitative analysis of impacts to wetlands, quantitative analysis was conducted by determining the acreage of wetlands affected by each alternative. This analysis relies on the more liberal Cowardin system of wetland classification used by the NPS. *Director's Order 77-1: Wetland Protection* (NPS 2002a) requires that the NPS use the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979) as the standard for defining, classifying, and inventorying wetlands. This system generally requires that a positive indicator of wetlands be present for only one of the indicators (vegetation, soils, or hydrology) rather than for all three parameters as mandated by the U.S. Army Corps of Engineers (ACOE) and Environmental Protection Agency (EPA) under the Clean Water Act (CWA). Impacts to jurisdictional wetlands based on the criteria established by the ACOE and EPA (under the CWA) will be made later to obtain necessary permits.

A *Draft Wetlands and Floodplains Statement of Findings* is included as Appendix 17 to document potential impacts on wetlands related to the preferred alternative. A jurisdictional wetlands survey of the proposed project area, including of the proposed Reroute Access Connector was completed in 2011 by FHWA.

**Type of Impact:** Adverse impacts would degrade the size, integrity, or connectivity of wetlands. Beneficial impacts would enlarge the size or enhance the integrity and connectivity of wetlands.

**Intensity of Impact:** Three primary measures were used to evaluate the intensity of impacts on wetlands: the size and type of the wetland, the integrity of the wetland, and the connectivity of the wetland to adjacent habitats.

- **Negligible** impacts would be imperceptible or not detectable.
- **Minor** impacts would be slightly detectable, localized within a small area, and would not affect the overall viability of wetlands in Lake Chelan NRA.
- **Moderate** impacts would be apparent and would have the potential to become major impacts if they persisted.
- **Major** impacts would be substantial, highly noticeable, and permanent.

## Wetlands Impacts

### *Impacts of Actions Common to Alternatives 1 - 5*

Wetlands are identified by wet soil characteristics, wetland-dependent vegetation, and/or the presence of water. Wetlands, which overlap with riparian areas, covered approximately 444 acres within Lake Chelan NRA in 1995. Wetlands are classified as palustrine (forested or scrub/shrub), riverine (open water or unconsolidated shore), and lacustrine (open water). Actions under the alternatives that occur in or near water would affect wetlands.

With many of the proposed actions, there would be short-term localized negligible to minor adverse effects on wetlands during construction and long-term negligible to moderate or major beneficial effects once implementation is complete. These impacts would be associated with specific areas and are described below, but would generally include adverse impacts from excavation for culverts and installation of erosion protection measures, and beneficial impacts from riparian restoration.

### Maintenance and Housing Replacement and Relocation

Removal of the maintenance facility and three houses from the floodplain near Harlequin Bridge would have long-term localized moderate to major beneficial effects on wetlands in the vicinity of the maintenance area. The parking areas, road surfaces, fuel storage, and septic systems would be relocated from their current location, adjacent to a wetland, to an upland area that would not affect wetlands.

### Road Rehabilitation

**Culverts:** For the rehabilitation of the Stehekin Valley Road between Harlequin Bridge and the beginning of the proposed reroutes (Alternatives 2, 3 and 5), which would be common to all alternatives, rehabilitation/reroute actions would include ditch relief culverts (spaced approximately every 500 feet on the existing road and every 300 - 350 feet on the reroute) as well as culverts for perennial or intermittent streams.

Actions affecting existing culverts would include replacing or extending them. Excavation near the exposed ends of the culverts for rip-rap rundowns and ongoing maintenance could affect palustrine forested wetlands where these were located at perennial or intermittent drainages (Alternatives 2, 3 and 5). Approximately seven perennial or intermittent drainages occur in the project area along the proposed reroute. Except for those on the reroute and at Milepost 5.3 (Wilson Creek), Milepost 8.5, Milepost 9.2, and Thimbleberry Creek, most culverts are or would be designed for snowmelt rather than for intermittent or perennial streams.

Most of the impacts for culvert installation on the reroute would affect 'non-wetland waterways,' or intermittent first and second order streams. These sites are seasonally wet during snowmelt and periods of prolonged rainfall. They lack wetland soils, vegetation, or standing water. During summer months these stream beds run dry and any water flowing from bedrock canyons above goes underground in the coarse glacial gravels and debris flow deposits.

Actions associated with culverts would have short-term minor adverse effects from construction, coupled with long-term negligible adverse effects from periodically cleaning out the culverts to maintain them. Ongoing repair of flood damage on the road would have minor long-term adverse impacts from introducing gravel into the river and adjacent wetlands.

**Water Withdrawal:** There would be negligible adverse effects on riverine wetlands from the periodic withdrawal of water (of more than one million gallons over three months) accessed from previously disturbed sites along the Stehekin Valley Road. Based on the withdrawal locations, withdrawal would not affect existing intact banks (riparian vegetation) or water flow in the Stehekin River. Intake screens would be used to avoid uptake of organic or mineral elements.

#### Restoration and Bioengineering

Approximately 1.5 acres of palustrine forested wetland in the former maintenance area would be restored after the removal of the maintenance functions, a localized long-term moderate to major beneficial effect from increasing wetland acreage and function near the Stehekin River.

### *Additional Impacts from Alternative 1*

#### Road Grade Raise

Retaining the road in its current alignment and raising it through McGregor Meadows would result in fewer opportunities for the river to create new wetlands and replenish existing ones in its channel migration zone, including natural palustrine forested and scrub-shrub wetlands in old flood channels in McGregor Meadows and in the Company Creek area. As a result, there would continue to be long-term localized moderate adverse impacts on wetlands at this location.

### *Additional Impacts from Alternatives 2 and 5*

#### Erosion Protection Measures

There would be minor to moderate adverse and beneficial impacts from implementing erosion protection measures (Table IV-15: *Impacts to Wetlands*). Some of the affected areas are riverine wetlands, including Frog Island and Boulder Creek. Stehekin River mouth and Wilson Creek sites, where steep river cut-banks intersect upland forest, currently have no riparian zone. Adverse effects from initial construction of the barbs and logjams would be minimized over time by restoration and bioengineering associated with barbs and would result in short-term localized minor adverse impacts where located at the edge of the channel migration zone (Frog Island, Wilson Creek and Boulder Creek), and moderate adverse effects where located within the channel migration zone (River Mouth).

#### Large Woody Debris

Collection of large woody debris would affect some riverine wetland (riparian) areas adjacent to the Stehekin River through compaction and potential vegetation disturbance and sedimentation when logs are obtained from the tops of logjams below Boulder Creek. Depending on the type of equipment used, the scale of removal, the success of mitigation measures, and access to the site, effects would be short term and negligible to minor.

#### Restoration and Bioengineering

Riparian restoration would occur along the Stehekin River at two locations that have been previously disturbed by human activities. At Buckner Homestead hayfield and pasture, a riparian area was converted to pasture and has recently been subjected to rapid erosion due to lack of native vegetation and sandy soils along the bank of the river. At Lower Field, native vegetation was removed and bank erosion is also proceeding at an unnaturally high rate. Riparian restoration associated with dense dogwood and willow plantings at Weaver Point, Frog Island, and the Stehekin River mouth would also have minor beneficial effects. Riparian restoration at Buckner Homestead hayfield and pasture and the Lower Field would have moderate beneficial effects. Not raising the road through McGregor Meadows would also allow old flood channels to

**Table IV-15: Impacts to Wetlands**

| Site | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 |
|---|---|---|---|---|---|
| **Adverse Impacts** | | | | | |
| Culvert installation perennial and inter-mittent creeks | Two 60 inch culverts (Wilson Ck)<br>Two 30 inch culverts (Milepost 8.5) | Same as Alternative 1 plus seven 60 inch culverts for reroute, one 72-inch culvert and two 36-inch culverts<br>Low-water crossing (Milepost 8.5)<br>Low-water crossing (Milepost 9.2) | Same as Alternative 2 | Same as Alternative 1 | Same as Alternative 2 except there would be a box culvert instead of a low-water crossing at Milepost 8.5 |
| Wilson Creek | Log-cribbing 0.21 ac | Rock barbs (see below) | Logjam (see below) | Rock barbs (see below) | Same as Alternative 2 |
| McGregor Meadows Grade Raise | 0.2 ac | N/A | N/A | 0.2 ac | N/A |
| Milepost 8.5 culvert | 0.02 ac | 0.02 ac | 0.02 ac | 0.02 ac | Same as Alternative 2 |
| Barbs / Logjams (adverse) | 0 | 6 - 8 barbs<br>0.45 - 0.59 ac<br>**Barbs**<br>0.21 River mouth<br>0.07 - 0.14 Frog Island<br>0.14 - 0.21 Wilson Ck<br>**Logjams**<br>0.01 River mouth<br>0.02 Boulder Ck | 4 barbs<br>0.58 ac<br>**Barbs**<br>0.14 Weaver Pt<br>0.14 Lower Field<br>**Logjams**<br>0.02 Weaver Pt<br>0.17 River mouth<br>0.02 Boulder Ck<br>0.03 Frog Island<br>0.06 Wilson Ck | 16 - 17 barbs<br>1.17 - 1.24 ac<br>**Barbs**<br>0.14 Weaver Pt<br>0.21 River mouth<br>0.07 - 0.14 Frog Island<br>0.21 Wilson Ck<br>0.14 Lower Field<br>0.14 Milepost 7.0<br>0.21 Milepost 9.2<br>**Logjams**<br>0.02 Weaver Pt<br>0.01 River mouth<br>0.02 Boulder Ck | Same as Alternative 2 |
| Reroute Access Connector | N/A | N/A | N/A | N/A | 0.1 ac |
| Former Skinny Wilson Home-stead | N/A | N/A | N/A | N/A | 0.05 ac |
| Total Adverse | 0.43 ac | 0.5 ac | 0.6 ac | 1.4 ac | 0.65 ac |

| Site | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 |
|---|---|---|---|---|---|
| **Beneficial Impacts (continued on next page)** | | | | | |
| Bioengineering Barbs and Logjams | 0 | 0.5 ac | 0.6 ac | 1.17 - 1.31 ac | Same as Alternative 2 |
| Riparian Restoration | 1.5 ac<br>**Restoration**<br>Maintenance area: 1.5 ac | 4.1 ac<br>**Restoration**<br>Maintenance area: 1.5 ac<br>Road reroute 1.46 ac<br>River mouth: 0.07 ac<br>Wilson Ck: 0.21 ac<br>Buckner: 0.34 ac<br>Lower Field:0.36 ac<br>Frog Island:0.21 ac | 3.9 ac<br>**Restoration**<br>Same as Alternative 2 except:<br>Road reroute: 1.0 ac<br>Weaver Pt: 0.18 ac | 2.9 ac<br>**Restoration**<br>Same as Alternative 2 except for road reroute | Same as Alternative 2 |
| Total Beneficial | 1.5 ac | 4.6 ac | 4.5 ac | 4.1 ac | 4.6 ac |

*Although culvert impacts are identified above, these are not considered "wetlands" under ACOE criteria. Instead, these are considered "stream channels" or "other waters of the U.S." The totals reflected above, however, follow the Cowardin classification of wetlands used by the NPS and show approximately slightly more adverse impacts than are recognized under ACOE criteria.*

be reoccupied. This would result in localized long-term minor to moderate beneficial effects on riverine wetlands, particularly at McGregor Meadows and Milepost 7.0.

### Road Reroutes / Priorities for Land Acquisition and Exchange

With the road reroute around McGregor Meadows and Lower Field, combined with the modified priorities for acquisition and exchange focusing on removing development from the floodplain and channel migration zone, there would be long-term beneficial impacts. These benefits would be associated with restoring natural river processes that allow the river to flood this area, renewing wetland areas. Approximately 1.5 acres of old road would be restored in the channel migration zone. At Milepost 7.0, the road currently cuts through a riparian wetland, and removal of the road fill would allow the wetland to function naturally. These actions would result in localized long-term negligible to moderate beneficial impacts on wetlands.

## *Additional Impacts from Alternative 3*

### Erosion Protection Measures

Effects are shown in Table IV-15: *Impacts to Wetlands*. Impacts would be similar to Alternative 2, with additional impacts from the barbs at Lower Field, plus logjams instead of barbs in some locations. As in Alternatives 2 and 5, adverse effects would occur from initial construction of the barbs and logjams but would be minimized over time by restoration and bioengineering. At these sites, short-term localized minor adverse effects would occur where actions are located at the edge of the channel migration zone (five sites), and moderate adverse effects where located within the channel migration zone (two sites). Long-term minor beneficial effects would occur at all six sites as a result of bioengineering.

### Restoration and Bioengineering

Actions and impacts would be the same as described in Alternatives 2 and 5, but there would be fewer acres restored (due to the shorter reroute) and ongoing impacts from location of the road next to the Lower Field. This would result in short-term negligible adverse effects from planting and other actions, coupled with long-term minor to moderate beneficial effects.

### Large Woody Debris

Actions and impacts would be the same as in Alternatives 2 and 5.

### Road Reroutes / Priorities for Land Acquisition and Exchange

Actions and impacts would be similar to Alternatives 2 and 5; however, because the reroute would be shorter, there would be less opportunity for the river adjacent to the Lower Field to migrate into its channel migration zone. Therefore, in Alternative 3 because of the reroute, there would be a slight decrease in available area for the river to create wetlands, a minor adverse effect.

## *Additional Impacts from Alternative 4*

### Road Grade Raise / Land Protection Plan

Actions and impacts would be similar to those described in Alternative 1; however, there would be additional opportunities to allow the river to migrate within its channel migration zone associated with new priorities for land acquisition and exchange, particularly near McGregor Meadows. This alternative would therefore have a minor to moderate beneficial effects not associated with Alternative 1.

### Erosion Protection Measures

Effects would be similar to Alternatives 2, 3 and 5, with minor beneficial and minor to moderate effects, but more moderate adverse effects would occur from placement of more structures. This alternative would have four new measures in the channel migration zone and five outside it.

### Large Woody Debris

Actions and impacts would be the same as described in Alternatives 2 and 5 except that because large woody debris would be procured from a larger area below Bullion Raft Launch to Lake Chelan, there would be additional localized short-term minor adverse effects.

**Restoration and Bioengineering**: Actions and impacts would be the same as described in Alternatives 2 and 5, except that there would be no reroute in Alternative 4, therefore, fewer riparian areas (not including bioengineering) would be restored.

## *Additional Impacts from Alternative 5*

In addition to impacts identified above associated with both Alternatives 2 and 5, there would be additional impacts in Alternative 5 from construction of the Reroute Access Connector.

### Reroute Access Connector

The lower 400 linear feet of the 940 - 1,200 foot long road that would connect McGregor Meadows to the reroute would cross a small wetland that occupies an ancient river channel. This palustrine-scrub-shrub wetland covers about 4 acres and the proposed access road would impact approximately 0.1 acres (3 percent). Impacts associated with the road would be long-term and minor to moderate because the road would be built at grade and would not impede water flowing into or out of the wetland. Primary impacts would be from removal of native vegetation and soils and replacement of these with large rocks and coarse gravel to form the road base. Flooding and erosion at the lower end of the existing route into McGregor Meadows are projected to become worse, and ultimately it is expected that all of the private land owners would use the 940 - 1,200 feet long, 12-feet wide Reroute Access Connector. Future potential abandonment of additional sections of road in this area would provide additional opportunities for wetlands to expand or be created. Removal of the road at the upper end of McGregor Meadows would allow flood water to move into the head of the wetland impacted by the spur road, and prevent water from following the road instead.

## Measures to Avoid, Minimize, or Mitigate Impacts

See "Measures to Avoid, Minimize, or Mitigate Impacts" in "Hydraulics and Streamflow Impacts."

## Cumulative Impacts

Of the approximately 2,300 acres in the lower Stehekin Valley affected by human activities, an estimated 188 acres of riparian areas (of the 283 acres of development) have been affected by development. This development in riparian areas (riverine wetlands) includes roads, houses, campgrounds, trails, and administrative facilities. Overall, actions in the alternatives would contribute localized long-term negligible to major beneficial effects from the removal of the road, maintenance area, and housing from the floodplain. Negligible to moderate adverse effects on wetlands would occur during installation of erosion protection measures. Alternative 1 would contribute both fewer beneficial and more adverse impacts. Alternative 4 would contribute slightly more beneficial impacts from restoration, bioengineering, and potential acquisition of lands within the channel migration zone than Alternative 1. Alternatives 2, 3 and 5 would have similar beneficial effects, although Alternatives 2 and 5 would contribute slightly fewer adverse effects due to the longer reroute. Alternative 5, however, would have additional impacts primarily from construction of the Reroute Access Connector, the lower end of which crosses a wetland. Because Alternatives 1 and 4 would restore wetlands at the maintenance area, but would not include additional development of wetlands (with the exception of barbs). Therefore their contribution to cumulative impacts on wetlands would be small in comparison to the number of acres where development currently affects riverine wetlands / riparian areas in the Stehekin Valley. Alternative 5, however, would include additional development of wetlands and would contribute a localized minor to moderate cumulative adverse effect on wetlands.

Actions proposed within the GMP and by other plans, including the Lake Chelan hydropower relicensing EA, would result in additional long-term beneficial effects and would not contribute to increased degradation of existing wetlands. For example, the GMP called for approximately 26 acres of habitat in or near wetlands to be restored where possible and another 63 to be protected by acquiring interests. The acquisition of wetlands would continue to be a high priority based on the LPP revisions in Alternatives 2 - 4 and 5.

## Conclusion

Overall, impacts from rehabilitation of old and installation of new culverts would be similar across the alternatives, with most impacts being short term, localized, and related to construction. In Alternatives 1 and 4, where the river would be more confined, it would move at higher velocities through constricted areas, indirectly resulting in less potential for creation and nourishment of wetlands from floodwaters reoccupying the floodplain and the river cutting new channels. In contrast, Alternatives 2, 3 and 5 would allow for expansion of wetland areas as the river continues to migrate within its floodplain in areas where the road was rerouted or in areas where additional lands within the floodplain or channel migration zone were protected.

**Alternative 1:** In Alternative 1, there would be the potential for additional loss of portions of the road and long-term localized moderate adverse impacts to wetlands from trying to maintain the road in its current alignment in McGregor Meadows. Actions at Wilson Creek would have long-term minor adverse effects on wetlands from installation of log-cribbing along the riverbank. Bioengineering and slope stabilization at Wilson Creek would also have long-term minor beneficial effects. Culvert replacement at Milepost 8.5 would have short-term negligible to minor impacts. There would be 0.43 acres of adverse impacts and 1.5 acres of restoration.

**Alternative 2:** In comparison, Alternative 2 would result in similar short-term minor adverse impacts from installation of more culverts coupled with more (negligible to moderate or major) localized beneficial effects from additional restoration of riparian areas, removal of the road from McGregor Meadows, and protection of property in the floodplain / channel migration zone. There would be 0.5 acres of adverse effects and 4.6 acres of restoration.

**Alternative 3:** Alternative 3 would have very similar effects on wetlands with the same riparian restoration impacts (negligible to moderate or major) from Alternative 2, and additional beneficial impacts from additional bioengineering, coupled with minor adverse impacts from the construction of barbs or logjams in two more locations. There would be 0.6 acres of adverse effects and 4.6 acres of restoration.

**Alternative 4:** Alternative 4 would result in the same beneficial impacts as Alternatives 2 and 3, but would have additional adverse impacts from trying to maintain the Stehekin Valley Road in its current alignment in McGregor Meadows. Similar to Alternative 1, impacts would range from negligible to moderate. Because potential riverine wetland impacts would occur, a *Draft Wetlands and Floodplains Statement of Findings* has been included as part of Appendix 17, but adequate mitigation would be available from the associated bioengineering and riparian restoration. There would be 1.4 acres of adverse effects and 4.1 acres of restoration.

**Alternative 5:** Impacts from Alternative 5 would be similar to those in Alternative 2. In addition, there would be impacts to 0.1 acres of wetland from the Reroute Access Connector. There would be 0.65 acres of adverse effects and 4.6 acres of restoration.

# 8. Floodplains Impacts

## Floodplains Methodology

A *Draft Wetlands and Floodplains Statement of Findings* has been included as Appendix 17 to analyze the impacts from the preferred alternatives, including installation of additional erosion protection measures, from changing policy associated with large woody debris, and from occupation of high-flood-hazard in the floodplain and on debris cones.

The impact analysis for floodplains was conducted based on site visits, analysis of Geographic Information System data layers of the floodplain landforms and side channels of the Stehekin River, a 1993 floodplain study (NPS 1993), a Statement of Findings for the Stehekin floodplain prepared by NPS staff (Riedel 2004), personal observations and professional judgment by NPS staff and the SRCIP technical committee, and by a new floodplain model developed by FHWA and the NPS.

**Type of Impact:** The removal of roads or structures from the 100- or 500-year floodplain would be considered a beneficial impact to human life or property and to natural floodplain values and functions. Development of new facilities in the 100- or 500-year floodplain would be considered an adverse impact to floodplain values. Class I actions include administrative, residential, warehouse, and maintenance buildings and overnight parking facilities. NPS policy is not to have these facilities in the 100 year floodplain. Class II actions include schools, hospitals, fuel-storage facilities, and emergency services. Based on the NPS Floodplain Management Guideline class II actions should be located out of the 500-year floodplain.

**Intensity of Impact:**

- **Negligible:** There would be no ongoing impacts or change in floodplain values and function. Actions would not contribute to increased severity or duration of flooding.
- **Minor:** Ongoing impacts or changes in floodplain values and functions, as described above, would be barely measurable and local. Actions would not contribute to the severity and/or duration of flooding, and most new erosion protection measures would be on the edge of the channel migration zone, where they would not limit channel migration (the area within which the Stehekin River has migrated during the past 1,000 years).
- **Moderate:** Ongoing impacts or changes in floodplain values and functions would be measurable and local. Actions would contribute to the severity or duration of flooding. New erosion protection structures may be within the channel migration zone, where they would limit channel movement and creation or recharge of floodplains.
- **Major:** There would be ongoing impacts or changes in floodplain values and functions that would be measurable and widespread. Actions would contribute to the severity or duration of flooding. New erosion protection measures may be within the channel migration zone on low banks.

## Floodplains Impacts

### *Impacts of Actions Common to Alternatives 1 - 5*

#### Ongoing Impacts

The Stehekin Valley Road is within the 100-year and 500-year floodplain and/or the channel migration zone (extreme floodplain) in two main locations, McGregor Meadows for approximately one miles and from the Bakery to Lake Chelan (see Figure III-3: *Lower Stehekin Valley Landforms below Harlequin Bridge*). Most of the Company Creek Road near Harlequin Bridge and above Company Creek is also within the 100-year floodplain. Both of these roads would continue to have long-term moderate to major adverse effects on floodplain values and functions, with effects in Alternatives 2, 3 and 5 from continued maintenance of the McGregor Meadows Access Road, rather than the Stehekin Valley Road, and effects in Alternatives 1 and 4 from retention of the road in its current alignment.

Numerous private homes and some administrative facilities are also located both within the 100-year floodplain and within the channel migration zone. Bank erosion, sediment, and large woody debris deposition during big floods have caused changes in the Stehekin River floodplain boundaries over time. Future floods are expected to continue to alter floodplain boundaries and to create conflicts with public and private development, particularly in developed deposition zones such as McGregor Meadows and the Stehekin River mouth (Figure I-5). Administrative facilities that would continue to remain within floodplains or the channel migration zone would include recreational facilities such as campgrounds and trails, actions that are excluded from compliance with the Floodplain Management Guideline. The presence of these facilities within the floodplain would continue to have negligible to minor adverse effects.

Under all alternatives, the Stehekin Valley Road would continue to remain adjacent to the floodplain and/or channel migration zone where reroutes cannot be undertaken, including at Mileposts 3.8 (Frog Island), 5.3 (Wilson Creek), and 8.0, a long-term minor to moderate adverse effect on floodplains because these areas are on the edge of the channel migration zone, and the barbs or logjams would not raise flood elevations. Relocating maintenance and housing facilities would remove most park facilities from the regulatory floodplain, a long-term major beneficial effect.

In all alternatives floodwaters would be able to overtop riverbanks, a minor to moderate long-term beneficial effect, except in the vicinity of the existing 400-foot-long Company Creek levee. The current height of the levee along the Company Creek Road is four to six feet above the road. The levee continues to take pressure off the lower section of the upper Company Creek Road by keeping floodwater from a small part of the floodplain and has a minor long-term impact on the floodplain in this area. The primary area where past road-protection actions have restricted the river is along the right bank of the river adjacent to the upper Company Creek Road, where 11 rock barbs have been installed since 1995. These structures restrict the river from about a third of the channel migration zone (see Table IV-12: *Lower Stehekin Shoreline Affected by Erosion Protection or Flood Control Structures*). There would continue to be a long-term moderate to major adverse effect in this reach. In addition, about 400 linear feet of rip-rap on the left bank near the river mouth, installed between 1960 and 1983 to protect private development, is within the channel migration zone and continues to have a moderate long-term adverse impact on floodplains. Most other reaches of the river are unaltered, allowing the river to utilize its floodplain and to store water, gravel and large wood.

### Erosion Protection Measures

Existing rock barbs and other structures would continue to restrict the river from some parts of the channel migration zone but would not raise floodwater elevation, because they are designed to be overtopped during high flows. Therefore, these erosion protection measures would have a negligible short-term adverse effect on flood elevation and a long-term minor to moderate adverse effect on channel migration, depending on how long they last and whether they are within gravel deposition zones or their location within the channel migration zones.

### Maintenance Facility Replacement and Relocation

Because the maintenance facility has remained within the regulatory100-year floodplain and fuel storage within the 500-year regulatory floodplain, the maintenance area has continued to have localized moderate to major adverse effects on the Stehekin River floodplain. Replacement and relocation of the facilities from this 5-acre site would result in long-term moderate to major beneficial effects from the restoration of a large area in the floodplain and reduced potential for adverse effects from pollution from fuel storage, vehicles, and other maintenance area activities and functions.

## *Additional Impacts from Alternative 1*

### Road Grade Raise

The retention and road grade raise of the Stehekin Valley Road through McGregor Meadows would exacerbate the present encroachment of the road on the floodplain. "Natural and beneficial floodplain values would both be diminished because the road grade raise results in the separation of the floodplain from the main channel. Because of this, hydraulic modeling indicates that this encroachment would result in an approximate 0.5 feet increase in floodwater elevation through McGregor Meadows. This could affect surrounding properties. Floodwater typically overtops the road by one to three feet. The elevated roadbed would likely affect river migration, the creation of new channels, and floodwater elevation over a wide area in McGregor Meadows. Elevating and hardening the road in the floodplain would likely accelerate movement of the river through McGregor Meadows and increase the amount of gravel and large woody debris in the channel downstream. The primary source of gravel in this area is currently cut-bank erosion on the west side of the channel. Maintaining the road in place by elevating and hardening it would also likely have direct adverse impacts to private property by raising floodwater height, increasing floodwater velocity, and accelerating movement of the river through this area. Right now, the alignment of the road and the river is a threat to private property because the road is a weak point in the floodplain -- likely to be exploited by future large floods. Localized moderate to major adverse impacts in the floodplain would also result from placement of 5,600 cubic yards of fill to elevate the roadbed within the 100-year floodplain / channel migration zone. Adverse effects could include loss of this fill during future flooding and the need for additional erosion protection measures to protect the road as the river encroaches upon it.

## *Additional Impacts from Alternative 2*

### Road Reroute

Unlike Alternative 1 (and 4) the road reroute in Alternatives 2, 3 and 5 would avoid additional encroachment in the floodplain / channel migration zone and would not result in a net increase in floodwater elevation above the existing condition. Rerouting the Stehekin Valley Road around the floodplain in McGregor Meadows and the Lower Field would have long-term moderate to major beneficial effects on the floodplain from restoring natural hydrologic and ecological processes. While the amount of restored floodplain is relatively small, surveys indicate that only two percent of the entire Stehekin River watershed is floodplain. Protecting these limited floodplain resources would therefore also have greater ecological value than protecting additional forested upland, which dominates the watershed. Benefits would be provided by slightly increasing the flood storage capacity of the floodplain, reducing the potential for erosion of the road, allowing the river more room to meander in these areas over time, and reducing the potential to restrict or channel flood flows. Retaining the McGregor Meadows Access Road, however, would contribute some localized long-term minor to moderate adverse effects. Keeping the road at grade over the short term and protection of private properties over the long term would reduce this impact.

### Erosion Protection Measures

In Alternatives 2 and 5, new erosion protection measures would be installed at three sites: near the river mouth, at Frog Island, and at Wilson Creek. Impacts to floodplains at Frog Island, Boulder Creek, and Wilson Creek would be minor because they are located at the edge of the channel migration zone, where river migration is limited by topography. Adverse impacts to floodplains at the river mouth bank stabilization site would be moderate and long term because it is located within the channel migration zone. There would also be long-term minor to moderate adverse effects from creating the access road to the river access site near the river mouth.

### Restoration and Bioengineering

Restoration of riparian vegetation at Lower Field and Buckner Homestead lower hayfield and pasture would restore natural floodplain function by reestablishing a riparian buffer zone of native forest vegetation where none currently exists. This would have long-term minor beneficial effects on the floodplain / channel migration zone in the general vicinity of these areas, which would likely increase as the vegetation matured and bank erosion slowed.

### Removal of Flood-Affected Structures

Demolition and removal of flood-affected structures from the floodplain, including septic tanks and drain fields, would result in localized long-term moderate to major beneficial effects. These developments continue to threaten the integrity of the Stehekin River floodplain, water quality, and other floodplain values.

### Land Protection Plan Modifications

With the modified priorities for acquisition and exchange focusing on removing development from not only the 100-year floodplain, but also the channel migration zone of the Stehekin River, there would be long-term moderate to major beneficial effects on floodplains and/or the channel migration zone, depending on which properties were acquired or exchanged, how long it took, and whether these contained development within the floodplain or channel migration zone.

### *Additional Impacts from Alternative 3*

Actions would be similar and impacts would be the same as described in Alternative 2 for restoration and bioengineering, removal of flood-affected structures, and LPP modifications.

#### Road Reroute

Rerouting the Stehekin Valley Road around McGregor Meadows would have long-term minor to moderate beneficial effects on the floodplain; however, these would be smaller in Alternative 3 than in Alternative 2 because more of the road (approximately 1.2 acres) would remain within the channel migration zone. Less of the roadway would also be restored within the floodplain / channel migration zone, compared to Alternative 2. As in Alternative 2, retaining the McGregor Meadows Access Road would continue to contribute some long-term minor to moderate adverse effects, depending on river changes and the frequency and severity of floods. A portion of the road reroute would remain within the channel migration zone would be where it connects to the existing road within the Lower Field. This would require placement of fill in the floodplain, a long-term moderate impact to floodplain function.

#### Erosion Protection Measures

Actions and impacts would be similar to Alternative 2, with logjams instead of barbs constructed at most locations, plus two additional barbs at the Lower Field and barbs and a logjam at Weaver Point. Because three of the sites are in the channel migration zone, there would be additional long-term minor to moderate adverse effects on floodplains from their construction, particularly at the river mouth.

### *Additional Impacts from Alternative 4*

Impacts from the road grade raise associated with increasing the floodwater elevation and potential effects on private property would be the same as in Alternative 1. Alternative 4 would continue to have moderate to major adverse effects from retaining parts of the Stehekin Valley Road and Company Creek Road in the floodplain / channel migration zone.

#### Erosion Protection Measures

Actions and impacts would be similar to Alternative 3, with barbs constructed at all locations, plus two near Milepost 7.0 and three near Milepost 9.2. Because both new locations are at high banks within the channel migration zone, there would be additional long-term minor to moderate adverse effects on floodplains from their construction.

#### Land Protection Plan Modifications

As in Alternatives 2 and 3, the modified priorities for acquisition and exchange would focus on protection of key resources, although to a lesser extent regarding removing development from the floodplain and channel migration zone. These actions would contribute minor to moderate beneficial effects on floodplains, depending on which properties were acquired or exchanged and how long it took.

### *Additional Impacts from Alternative 5*

Impacts would be the same as described for Alternative 2 except for differences associated with LPP modifications.

Land Protection Plan Modifications

With the modified priorities for acquisition and exchange focusing primarily on areas at McGregor Meadows, there would be long-term moderate to major beneficial effects on floodplains and/or the channel migration zone, depending on which properties were acquired or exchanged, and how long it took.

## Measures to Avoid, Minimize, or Mitigate Impacts

See "Measures to Avoid, Minimize, or Mitigate Impacts" in "Hydraulics and Streamflow Impacts."

## Cumulative Impacts

Past development, erosion protection and flood-control projects have had minor to moderate cumulative adverse effects on how water spreads across the floodplain and how water is conveyed downstream. These projects have also affected the ability of the floodplain to store water and to flush wetlands and side channels. Past actions included construction of the Stehekin Valley Road, the Company Creek Road and levee, and Harlequin Bridge; the placement of fill at various locations in the floodplain; and channelization of the Stehekin River with bank hardening that limited the natural migration of the river and the natural functions of the floodplain. The levee and maintenance of the Company Creek Road have resulted in the construction of log-cribbing, 11 rock barbs, and several grade-control structures in an effort to keep the river from destroying the road. These features have reduced the beneficial processes of off-channel flooding and channel migration, wetland formation, sediment and woody debris transport, and formation / renewal of plant and animal habitats in the riparian zone. In the McGregor Meadows reach, these actions have had a moderate to major long-term cumulative impact on floodplains. In other parts of the lower Stehekin Valley, cumulative impacts have been minor.

The placement of fill within a floodplain blocks the flow of floodwaters until they rise to overtop it. Where vegetation is removed and the road is within the floodplain, the road has often served as a conduit for floodwaters, which have removed road fill during floods. Where the road remains in the floodplain, there is the potential for the river to create a new channel along or down the road.

Under the proposed plan, large parts of the Stehekin River floodplain would remain in a natural state. This includes most areas above McGregor Meadows and most of the right bank below Harlequin Bridge. Alternatives 1 and 4 would contribute additional moderate adverse cumulative effects from the placement of additional fill within the floodplain to raise the section of roadway through McGregor Meadows. Alternatives 2, 3 and 5 would not place additional fill in this area, but would retain a portion of Stehekin Valley Road in the floodplain at grade, contributing some continued minor adverse effects. Maintenance of the grade-control structure at Milepost 6.8, at the north end of McGregor Meadows, would also impede channel migration (avulsion) into a portion of McGregor Meadows as would construction of three additional grade control structures in Alternative 5. At the same time, there would be a long-term moderate to major beneficial effect from the reroute(s). There would be an additional contribution of localized minor to moderate adverse effects from all alternatives from the placement of barbs within the Stehekin River channel / floodplain where the road either cannot be moved (Alternatives 1 and 4) or where reroutes (Alternatives 2, 3 and 5) are not possible. Long-term moderate to major beneficial effects would be contributed in Alternatives 2 - 5 from the changed priorities for land acquisition and exchange that could allow for removal of more development from the channel migration zone. All action Alternatives (2 - 5) would move toward less development within the floodplain, a long-term minor to major beneficial effect, depending on the alternative.

Although all alternatives would contribute to cumulative impacts, Alternative 1, followed by Alternative 4 would have the greatest adverse impacts to floodplains from continuing to retain and maintain the Stehekin Valley Road in McGregor Meadows. Alternatives 2 /5 and 3 would have increasing contributions to cumulative effects (though fewer than in Alternatives 1 and 4) but would also reduce cumulative effects by relocating a portion of the road outside the floodplain / channel migration zone. Because of the proposed reroutes, these alternatives would also have the fewest new erosion protection measures. Alternative 5 however would result in construction of the Reroute Access Connector through a wetland and 1,000 linear feet of grade control structures. The lower 400 feet of the connector would be within the floodplain, but would be built at grade and would not impede water flow.

## Conclusion

All alternatives would continue to have moderate to major adverse effects from retaining parts of the Stehekin Valley Road and Company Creek Road in the floodplain. The combined effects of the actions in Alternative 1 would result in a series of localized long-term negligible to major adverse effects from several actions. These include retaining the road, levee, and existing and additional erosion protection measures. In addition, there would be long-term localized major beneficial effects from the replacement and relocation and restoration of the maintenance facilities and housing outside the floodplain and the channel migration zone.

Alternatives 2 and 5 would result in similar negligible to moderate adverse effects from additional erosion protection measures and from maintaining the McGregor Meadows Access Road, while there would be more long-term moderate to major beneficial effects from the road reroute, restoration, and LPP priority changes that could lead to removal of structures and septic systems from the floodplain. There would be improvements to floodplain function from restoration of the former maintenance area, road reroute (McGregor Meadows and Lower Field), riparian restoration, and bioengineering. Because Alternative 5 would also include the Reroute Access Connector, it would have slightly greater adverse impacts, but the same combination of beneficial impacts. Although LPP priorities would also be different in Alternative 5, the focus on changing the degree of development in the areas most vulnerable to flooding would improve floodplain conditions and functions.

Alternative 3 would have effects similar to Alternatives 2 and 5, including a range of negligible to moderate adverse and beneficial impacts from many of the same actions. In Alternative 3, however, these would include fewer beneficial effects from the shorter reroute and from the implementation of additional erosion protection measures in areas where the road is within the floodplain / channel migration zone, such as at Weaver Point and the Lower Field. As in

Alternatives 2 and 5, there would be improvements primarily within the floodplain from removal of the maintenance area, road reroute (though only up to the Lower Field), riparian restoration, and bioengineering.

Alternative 4 would retain the Stehekin Valley Road in its current alignment, a long-term moderate to major adverse effect on floodplains because floodplains are one of the most limited habitats in the Stehekin River watershed (comprising only two percent of its area) and have high ecological value. These impacts would be combined with the erosion protection and restoration measures in Alternatives 2 / 5 and 3, resulting in some long-term negligible to moderate beneficial effects. While overall adverse effects would be less than in Alternative 1, they would be greater than in Alternatives 2 and 3, primarily as a result of installing 16 - 17 new rock barbs to retain the road in its current location and because of different LPP priorities. There would be moderate beneficial impacts within the floodplain from the replacement and relocation of the maintenance facility, riparian restoration, and bioengineering.

# 9. Fish and Wildlife Impacts

Impacts on fish and wildlife are assessed in terms of changes in the amount and distribution of wildlife habitat, the size and connectivity of habitat, the integrity of the site (including past disturbance), the potential for habituation of wildlife to humans, and the relative importance of habitats.

## Fish and Wildlife Methodology

Habitat types were based on the Tanimoto vegetation classification (Tanimoto 1991), the Washington State Gap Analysis for vertebrate animals, Kuntz and Glesne (1993), the Chelan PUD Lake Chelan vertebrate inventory (Chelan PUD 2002), the North Cascades NPS Complex Wildlife Database, and best professional knowledge.

Wildlife analysis was based on a qualitative assessment of wildlife that could occur in the project area and the effects anticipated as a result of ongoing activities, new activities, and rehabilitation, and/or construction. Actions were also assessed as to their potential for causing human/wildlife conflicts resulting from increased recreation disturbance in sensitive habitats and the introduction of unnatural food sources. Recreational impacts can result in changes in animal behavior, increased mortality, and altered habitat use.

**Type of Impact:** Adverse impacts would reduce the size, continuity, connectivity, or diminish the quality or integrity of wildlife habitat, or result in unnatural changes in the abundance, diversity, or distribution of wildlife species. Adverse impacts also include those that directly remove, relocate, or affect fish and wildlife or their habitat or that indirectly affect fish and wildlife or their habitat through increased disturbance. Disturbance, including noise, can adversely affect wildlife foraging, mating, and nesting behavior as well as fish foraging, spawning, incubation and rearing. Construction activity can also directly interfere with normal animal movement patterns. Beneficial impacts would result from restoration of wildlife habitat (size, continuity, or integrity).

**Intensity of Impact:**

- **Negligible:** These impacts would not be measurable or perceptible.

- **Minor** impacts would be measurable or perceptible and would be localized within a relatively small area; however, the overall viability of wildlife would not be affected. Without further impacts wildlife populations or species would recover.
- **Moderate** impacts would be sufficient to cause a change in the abundance, distribution, quantity, or quality of wildlife or wildlife habitat; however, the impact would remain localized. The change would be measurable and perceptible.
- **Major:** These Impacts would be substantial and highly noticeable, and could cause widespread changes in species or populations.

## Fish and Wildlife Impacts

### *Impacts from Actions Common to All Alternatives (1 - 5)*

The following general impacts (noise and activity during construction, habitat modification, sediment and fill and other impacts) would occur under all alternatives (differences are noted).

#### General Impacts

**Noise and Activity during Construction:** Above ambient noise and activity would occur during project implementation. Road rehabilitation (Alternatives 1 - 5) and reroute construction (Alternatives 2, 3 and 5) would coincide with the peak visitor use season, when some of the heaviest visitor use and traffic occurs. The noise and activity associated with the construction would be in addition to the noise and disruption of wildlife caused by visitor use. Because construction noise and activity would be concentrated in various locations throughout the visitor use season, wildlife, particularly medium and large mammals, would tend to avoid construction areas during daylight hours when project work was occurring. In the evening and on weekends when work would generally cease, wildlife would be expected to return to the project areas. Some species, such as birds, deer, and squirrels, might also be seen throughout the day. Road rehabilitation impacts would be localized alongside an already highly modified road corridor whereas reroute construction would occur in an area once disturbed by a wagon road and would have greater impacts on disturbing wildlife unused to noise and activity from visitors or construction. Because a great deal of suitable habitat for wildlife would continue to be present in the vicinity, most wildlife disturbance impacts would be short term, localized, and negligible to minor in the context of the lower valley.

**Habitat Modification:** Staging of machinery and construction materials would cause some vegetation to be removed, trampled, or run over. These activities would affect wildlife habitat until the areas were restored. Excavation needed to repair various portions of the road would likely result in disturbance and mortality of some small mammals, amphibians and invertebrates. Habitat modification due to vegetation removal varies under all alternatives but would preclude short- and long-term return to the former level of use by some species of wildlife. Perching birds, in particular, use trees and shrubs for roosting, nesting, and food or to forage for food. Therefore, habitat loss would have long-term localized minor to moderate effects from incremental loss of trees and associated habitat that may have been used for perching, nesting, or procurement of food for a variety of species. Over time, restoration of habitat could offset some of these impacts.

**Vehicle Travel:** In addition, there would continue to be vehicle-wildlife collisions on the road as a result of normal use. Vehicle travel speed varies by season and road area. Minor alignment changes would not be expected to result in faster speeds. If faster speeds do occur, particularly on the newly paved upper section of road, there would be greater potential for vehicle-wildlife collisions, resulting in a minor long-term adverse effect on wildlife use in the project areas.

**Sediment and Fill:** Road work in some areas also has the potential to cause sedimentation in adjacent or nearby aquatic habitat, should BMPs fail. Sedimentation can have negative consequences on fish and amphibian species occurring in, and downstream of, areas where sedimentation occurs. Because sediment barriers would be used and would remain in place during rehabilitation / restoration, however, impacts to wildlife from these measures would be minor and short term, having no lasting effects beyond construction. After construction, there would be few adverse impacts; however chronic long-term impacts to aquatic habitat would be reduced if restoration and rehabilitation efforts are successful. The importation of fill materials, including topsoil, combined with compaction from construction equipment has the potential to change the soil's physical and chemical composition and therefore its viability for some organisms, a minor impact because of the coarse nature of most valley soils.

**Restoration:** Restoration of the former maintenance area would have a long-term negligible to moderate localized beneficial impact in increasing native plant cover and decreasing invasive nonnative plant abundance, improving wetland and edge habitat for a wide-range of local wildlife species.

**Other Impacts from Construction:** The following additional impacts from construction would also affect wildlife:

- Dust and light emanating from construction sites would affect the use of surrounding habitats by wildlife.
- Diversion of water flows during construction would result in unnatural dewatering of aquatic habitats and/or wetting of terrestrial habitats adjacent to sites.
- Wildlife could be killed by traffic or machinery associated with construction.
- Pits and trenches could entrap and potentially kill wildlife.
- Although required best management practices would be used, there is a slight possibility that inadvertent spills of fuel, oil, hydraulic fluid, antifreeze, and other toxic chemicals could affect wildlife, especially if spills are large or if they reached surface water.
- Construction personnel at area residences or at work sites could provide a source of human food to wildlife, resulting in habituation of wildlife and in human/wildlife conflicts that adherence to mitigation measures would prevent.

Combined, these would result in short- and long-term negligible to moderate localized impacts on wildlife in the construction area that would be diminished by mitigation measures.

### Maintenance Facility and Housing Replacement and Relocation

Construction would result in long-term loss of habitat for wildlife species, although much of this area near the airstrip has been previously disturbed. There would be long-term minor to moderate adverse effects on wildlife, including from habitat loss and noise, but also from short-term impacts due to noise and disturbance during construction.

### Road Rehabilitation

Most road rehabilitation actions would result in minimal new disturbance of areas outside the existing road surface. In general, these actions would have short-term effects during construction from noise and disturbance which would cause wildlife to avoid the area. In some areas, such as road pullouts, however, proposed actions would result in long-term effects from the loss of vegetation, including wildlife habitat.

Among the actions in all alternatives which would result in ongoing noise and disturbance to wildlife would be road rehabilitation and maintenance and facility maintenance. The road rehabilitation actions which would remove wildlife habitat would include construction of the new pullouts, new culverts, and the winter turnaround, as well as actions at Wilson Creek would have localized short- and long-term negligible to moderate impacts on fish, amphibian and wildlife presence. Ongoing work to repair the road (including crack sealing, asphalt overlays, etc.) would result in periodic noise and human presence that would have localized short-term negligible to minor impacts on wildlife presence.

If a larger flood claimed part of the road and caused the loss of surface and/or subsurface materials, wildlife habitat would be altered, water quality in the Stehekin River would be degraded, and longer-term noise associated with reconstruction of the roadway would result in short-term minor to moderate adverse impacts on wildlife.

**Surfacing:** Road surfacing would minimize sediment runoff from the road, but would also increase impervious areas, causing faster runoff. Surfacing would also increase the delivery of contaminants such as petroleum products originating from the asphalt, adversely affecting water quality for wildlife. Paving of the upper section of the road could also increase the potential for speeding and adversely affect wildlife.

**Water Withdrawal:** There would be negligible adverse effects on fish and wildlife from the periodic withdrawal of water (of approximately one million gallons over three months) accessed from previously disturbed sites (established pull-outs) along the Stehekin Valley Road. Based on the locations, withdrawal would not affect existing intact banks or water flow in the Stehekin River. Intake screens and withdrawal from deeper water would be used to avoid uptake of aquatic organisms or streambed components.

### Erosion Protection Measures

**Milepost 5.3 (Wilson Creek):** Excavation to lay back the slope would have minor adverse effects on wildlife from some reduction in habitat. Instream work in Wilson Creek could cause sedimentation in the creek, and subsequently the Stehekin River downstream of the construction, if required best management practices are unsuccessful. Wilson Creek is an intermittent stream; however, construction would only take place when it is dry. Additional potential for sedimentation that could affect aquatic wildlife would also occur as a result of the lowering of the road surface and its realignment into the new cut. These adverse impacts, including noise and disturbance, would be short term, localized, and minor. Adverse impacts from sedimentation would be short-term and minor if restoration and rehabilitation efforts are successful. Otherwise, there would be long-term moderate adverse impacts.

### Recreational Facilities

**Lower Valley Trail:** Construction of about half of the trail would result in long-term loss of mostly undisturbed habitat for wildlife. Because the trail would be narrow, however, impacts would be negligible to minor. Localized minor to moderate adverse effects on wildlife would include habitat loss and short-term impacts due to noise and disturbance during construction.

### Restoration and Bioengineering

Restoration in all alternatives would include approximately 5 acres of riparian and upland habitat in the former maintenance area, plus areas of former development associated with land purchases and exchanges. Most of these areas are disturbed but could become high-quality habitat through restoration. Over time, long-term beneficial effects would occur and would increase wildlife habitat.

## *Additional Impacts from Alternative 1*

### Road Grade Raise

The road grade raise in McGregor Meadows would potentially cause additional sedimentation in the Stehekin River and adjacent wetlands during future flooding from the addition of 5,600 cubic yards of fill. To some degree, the erosion of this fill would be prevented by its compaction and by raising the road in selected areas. If dislodged, sediment from the road would result in short-term moderate adverse effects on fish and other aquatic species in the Stehekin River, particularly just downstream of where the material entered the river. Because most of this material would be imported, there would be the potential for long-term minor adverse effects from potential importation of weed seed as well as additional minor impacts (noise and activity) from moving this material from Stehekin Landing upvalley to McGregor Meadows. Encroachment of the Stehekin River on this low lying section of the road would, over the long-term, result in the need for more erosion protection structures and associated disturbance, a long-term moderate adverse impact.

### Road Realignment

Construction of the proposed realignment near Milepost 6.0 also has the potential to introduce sediment into the Stehekin River via numerous small unnamed first and second order tributary streams within the realignment area. Because mitigation measures would be used, there would be negligible to minor sedimentation impacts. As with other areas, impacts would remain small if required best management practices are effective and if restoration / rehabilitation measures are successful.

### Erosion Protection Measures

There would be additional impacts from the placement of rip-rap clusters and log-cribbing at the toe of the slope adjacent to the river at Wilson Creek. These structures would reduce aquatic habitat and change conditions adjacent to them within the river and alongside the bank, a long-term localized moderate adverse effect.

### Large Woody Debris

Continued procurement of large woody debris from the head of Lake Chelan for use in erosion protection measures would result in minor to moderate short- and long-term adverse impacts to fish and other aquatic species.

### Implementation of 1995 Land Protection Plan

Continued exchange and acquisition of lands based on the priorities of the 1995 LPP would result in the acquisition of lands within the 100-year floodplain of the Stehekin River and lands where protection of the scenic qualities along the Stehekin Valley Road would be achieved. Removal of structures from flood-affected lands would continue to occur, as would removal of structures from lands within the floodplain. These actions would result in long-term negligible to moderate beneficial effects on wildlife from protection of additional disturbed habitat that would be restored in the riparian zone. Retention of 20 acres at the Lower Field in the lands available for exchange could have localized long-term minor to moderate adverse impacts to wildlife. This area of the valley is currently undeveloped, and contains valuable habitat for a number of species. As a result, in Alternative 1, future revision of the LPP could remove the Lower Field from exchange consideration. Adverse effects on wildlife would continue to occur from the development of previously undeveloped and/or intact parcels offered for exchange. Depending on the size and features of the parcels, these adverse impacts would be negligible to moderate and localized.

Because the proposed land exchange parcels in the 1995 LPP are over 1 acre (1.33 acres to 7.2 acres) and because most of the land associated with the larger parcels would likely remain undeveloped (as a result of Chelan County zoning and NPS covenants), development of portions of the 10 - 15 parcels would have limited adverse effects on wildlife habitat. These impacts would be from the conversion of native landscape to developed area and from the potential invasion of nonnative species associated with the development. Considering these factors and restoration of some developed areas, these impacts would likely remain minor to moderate. Specific adverse or beneficial impacts of this plan and its actions, however, are currently unknown and would be analyzed as the land exchanges occur.

## *Additional Impacts from Alternative 2*

### Road Reroute

The road reroute would affect approximately 1.8 miles of mostly undisturbed habitat (up to 13 acres within an overall disturbance area of 23 acres), including the long-term removal of vegetation / wildlife habitat from the road bed, a long-term localized moderate to major adverse impact. In addition to vegetation removal along the road alignment, there would be removal of large boulders and some bedrock. This would require the use of an excavator-mounted hydraulic impact hammer and/or blasting and/or expansion grout, depending on the location and size of the rock. Because effects from breaking apart rock would likely result in repetitive noise impacts, it would be done outside the nesting season for sensitive species but would likely result in short-term moderate adverse impacts on wildlife.

There would also be short- to long-term adverse impacts from the loss of habitat in cut and fill areas. Adjacent forest would be lost where cuts and fills were constructed, resulting in fewer perches and nest sites for birds and less cover for mammals, as well as a change in the microclimate, with fewer trees contributing to changes in sunlight and shading, among other impacts. Negligible beneficial effects would result from the creation of edge habitat for wildlife. The road would increase the possibility of wildlife mortality along this edge. Because the road reroute would result in the removal of vegetation and the conversion of the area from native landscape to developed, effects from habitat loss would be long-term and moderate to major. Over time, however, it is likely that vegetation would return to many of the cut and fill areas, though not to the same level, a negligible to minor long-term beneficial effect. Some soil-dwelling organisms would be killed during construction, because of the extensive cover of this upland forest habitat, a localized, minor, short-term adverse impact.

Impacts to upland habitat on the reroute would be offset to some degree by removal of one miles of road from the floodplain in McGregor Meadows. Since the lower valley (and watershed) contain far less riparian than upland habitat, this restoration of riparian habitat would result in a moderate to major long-term benefit for wildlife.

### Erosion Protection Measures

Although the construction of six to eight rock barbs and two logjams would result in additional adverse impacts, the barbs would also decrease bank erosion during flooding and along the Stehekin River. Construction of the barbs and logjams would include rehabilitating riverbanks with bioengineering, contributing long-term, stable vegetation that would eventually spread over nearby areas and act as cover overhanging the bank for fish and other aquatic species and increasing riverbank cover vegetation for terrestrial species. As riverbank cover increased from bioengineering, minor to moderate beneficial effects would occur from shading of aquatic habitat. Pool habitat creation (6,000 - 8,000 square feet) from placement of the barbs would add to the diversity of Stehekin River habitats. There would be minor effects on gravel recruitment downstream of the barbs; however, eddies and pools created by the barbs would enhance local fish habitat for feeding and resting and would provide refuges during flooding. Up to approximately 0.5 acre would be affected by rock barbs and bioengineering, and 0.1 acre by logjams, including short-term minor to moderate and long-term minor adverse effects on wildlife habitat, (from sedimentation and possible fish passage impacts) and long-term negligible to minor beneficial effects from bioengineering.

**Milepost 8.0 Slope Stabilization**: There would be negligible to minor short-term adverse impacts on wildlife habitat from laying back the upper one-fourth to one-third of the slope and from rock scaling. Long-term beneficial effects would be contributed from slope stabilization.

### Large Woody Debris

Procurement of large woody debris in the Lake Chelan backwater zone would result in minor to moderate short- and long-term adverse impacts from noise and habitat disturbance. Because the procurement of the wood below Boulder Creek would be subject to a number of key stipulations, including that it be obtained from the tops of logjams well above the ordinary high water mark and in a way that did not affect the stability of the logjam, potential adverse effects on aquatic species would be minimized. The NPS would also closely monitor access to these sites, and sensitive habitat would not be disturbed. Surveys for sensitive species and habitats would be conducted before pieces were removed to further limit adverse impacts. Wood above the ordinary high water mark would be drier than wood below and the procurement of a limited number of pieces would have a minor effect on the recruitment of large woody debris within the channel that would be available in the future for wildlife habitat. Based on large woody debris surveys over the last 15 years, the presence of wood in the Stehekin River has quadrupled since 1982. Most wood was deposited in the 1995, 2003, and 2006 floods. Below Harlequin Bridge the dramatic increase could be a return to conditions prior to routine removal of large woody debris by settlers and the ACOE for many years or it could be a new occurrence. Minimal use of large woody debris, under a set of very specific conditions, would have negligible to minor adverse effects on the presence of this key habitat component in the Stehekin River. Use of the large wood instead of imported rock in erosion protection designs and restoration of riparian areas would also result in long-term minor beneficial effects on both aquatic and terrestrial wildlife.

### Recreational Facilities

**Campgrounds and River Access Point:** In addition to the construction of the Lower Valley Trail, there would be minor habitat modification from construction of the new campgrounds at Rainbow Falls, new group sites at Purple Point, a river access point, and a new, 300-foot-long access road. This would include changes in noise and activity during early morning and late evening hours related to use of the campsites, and changes during other times of the day associated with the river access point. This disturbance would result in wildlife avoidance of campgrounds and the river access point during these times. During other times, wildlife may be attracted to the smells from food preparation and activity at the campsites. Because campers would be required to store their food in lockers and would be encouraged to use wildlife-friendly camping practices, the effects of campsite use on wildlife would be minimized. Overall effects would be intermittent, localized, and negligible to moderate from noise and disturbance and long term with negligible to minor impacts from habitat modification.

### Restoration and Bioengineering

In addition to beneficial impacts from restoration of the former maintenance area and from lands acquired or exchanged, long-term beneficial effects would occur from the road reroute because of obliteration and restoration of the abandoned roadbed in the channel migration (including riparian) zone, where biodiversity would be restored, creating new habitat and rehabilitating degraded habitat for wildlife. In addition, riparian restoration at Buckner Homestead lower hayfield and pasture and Lower Field would also contribute to beneficial effects. Birds, insects, and mammals would benefit from the reestablished vegetation, soils, and diverse habitat offered by restored riparian and floodplain ecosystems. More of the Stehekin River channel migration zone would be available for fish, amphibian, insect, bird, and mammal use. Natural river processes would continue to allow for fish spawning, rearing, resting, and foraging. Amphibians and reptiles would gain high-value habitat in the restored floodplain / channel migration zone and riparian areas. Although there would be short- and long-term moderate adverse impacts on wildlife from the road reroute, restoring high-value floodplain and riparian zones would also create moderate beneficial long-term impacts for fish and wildlife.

### Land Protection Plan Modifications

With the potential development of additional home sites on 10 - 15 parcels for proposed exchange lands, and the subsequent rehabilitation or restoration of a similar area from exchanged or acquired lands, effects would be somewhat balanced. Because much of the acquisition and exchange would occur in more sensitive riparian wildlife habitats, and because most of the lands proposed for exchange are located in more common upland habitat types, there could be some long-term minor to moderate beneficial effects on some wildlife species, particularly riparian associates. Removal of the Lower Field area from consideration for exchange would have a long-term localized moderate beneficial effect because there is currently no development on this large, diverse parcel of key importance to wildlife. Exchanges would primarily result in NPS acquisition of wildlife habitats nearer to the Stehekin River in trade for areas farther away. As noted in the "Soils and Vegetation" section above, covenants and other stipulations on the development of exchanged lands would result in additional protection of key characteristics important to wildlife, a long-term negligible to minor beneficial effect on wildlife.

Because the proposed land exchange parcels are larger than 1 acre (1.33 acres to 7.2 acres) and because most of the land on the larger parcels would likely remain undeveloped (as a result of Chelan County zoning and NPS covenants), development of portions of these 13 parcels would have adverse effects on wildlife habitat. These impacts include conversion of native landscape to developed area and potential invasion of nonnative species. Although there would be restoration of some developed areas, these adverse impacts would likely remain minor to moderate.

### *Additional Impacts from Alternative 3*

#### Road Reroute

The road reroute would affect approximately 1.6 miles of mostly undisturbed habitat (13 acres within an overall disturbance area of 23 acres). Because the road reroute would result in the removal of vegetation and the conversion of the area from native landscape to developed, adverse effects on wildlife from habitat loss would be the same as Alternatives 2 and 5, based on the number of acres. Impacts would occur over most of the same areas, but would result from a shorter overall length of road. Effects from Alternative 3 would be long term and moderate to major.

#### Erosion Protection Measures

Instead of six to eight barbs and two logjams, as in Alternative 2, there would be four barbs and five logjams in Alternative 3. Overall adverse and beneficial impacts would be greater than in Alternative 2, but would be similar, including rehabilitating riverbanks with bioengineering, contributing long-term stable vegetation, and increasing the availability of pool habitat in the Stehekin River by 4,000 square feet. Approximately 0.6 acre would be affected by erosion protection measures, resulting in short- and long-term minor to moderate adverse effects, coupled with negligible to minor beneficial effects from bioengineering.

#### Milepost 8.0 / Large Woody Debris / Land Protection Plan Modifications / Restoration

Actions and impacts would be similar to Alternatives 2 and 5 except that there would be less restoration of the former Stehekin Valley Road alignment bypassed by the reroute

#### Recreational Facilities

**Campgrounds:** There would be a small additional area affected by the construction of another campground near Company Creek but no area affected by addition of a river access point. When combined with impacts from other recreational facility improvements similar to Alternative 2, overall adverse effects on wildlife would be intermittent and negligible to moderate from noise and disturbance and long term and minor from habitat modification.

### *Additional Impacts from Alternative 4*

Some impacts would be similar to Alternatives 1 and 3. As in Alternative 1, the Stehekin Valley Road would be maintained in its current alignment and its grade would be raised. As in Alternative 3, there would be beneficial and adverse impacts from Milepost 8.0 actions and restoration and bioengineering.

#### Road Grade Raise / Realignment

Road grade raise and realignment actions and impacts would be the same as in Alternative 1. There would be short- and long-term minor to moderate adverse impacts on wildlife, including aquatic species, especially if new road fill was released during future flooding.

#### Erosion Protection Measures

Construction of 16 - 17 barbs would result in additional adverse impacts to riverbanks from hardening (1.2 acres) and would affect up to 17,000 square feet within the river by changes from riffle to pool habitat. Additional locations with barbs include Milepost 7.0 and Milepost 9.2. Other effects would be the same as described in Alternative 3. The barbs would have a long-term moderate adverse effect on wildlife but would also have some negligible to minor beneficial effects from bank-erosion prevention and retention/restoration of plants along the riverbank, which would provide habitat for terrestrial and aquatic wildlife.

#### Large Woody Debris

Effects of the procurement and use of large woody debris would be greater than described in Alternatives 2 and 3 because it would occur over a much larger area, up to Bullion Raft Launch. There would be minor localized adverse effects on sedimentation, potentially affecting aquatic species and other wildlife (from disturbance), and there would be a negligible adverse impact on wildlife habitat for both terrestrial and aquatic species.

#### Land Protection Plan Modifications

Although priorities would be different, impacts would be similar to Alternatives 2 and 3 because the same lands would be available for exchange. Because there would continue to be lands within the channel migration zone that would be developed, potentially to protect the alignment of the Stehekin Valley Road, adverse impacts from development would be greater due to the overall greater sensitivity of lands, including lands within riparian areas, to be developed. Overall impacts on wildlife would be mixed, and would be long term, adverse, and minor to moderate, with fewer beneficial effects than Alternatives 2 and 3.

### *Additional Impacts from Alternative 5*

Impacts would be similar to those described in Alternative 2. Although the LPP would be revised differently and there would be two additional parcels available, the overall impacts of potential exchange or acquisition of 29 rather than 24 acres would only be slightly more beneficial, depending on which parcels were actually exchanged and which were acquired in their place. In addition, there would be development impacts on up to 1.0 - 1.2 acres for development of a 940 - 1,200 foot long Reroute Access Connector. Initially the impact of the Connector would affect only upland forested habitat, however the lower 80 feet would cross a wetland to connect with the Stehekin Valley Road. This palustrine-scrub-shrub wetland is located on private property and would result in a long-term minor to moderate adverse effect on wildlife.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to fish and wildlife would include the following:

- Scheduling construction activities with seasonal consideration of wildlife lifecycles to minimize impacts during sensitive periods (e.g., bird nesting). The timing of the construction of rock barbs and other channel- or bank stabilization measures as well as extraction of large woody debris would be limited to avoid spawning and other sensitive periods for fish and aquatic wildlife.
- Minimizing the degree of habitat removal (vegetation clearing) by delineating construction limits.
- Limiting the effects of light and noise on wildlife habitat through controls on construction equipment and timing of construction activities, such as limiting construction to daylight hours to the extent practicable.
- At the end of the day cover excavated pits and trenches to prevent animals from being trapped.
- Soil and erosion control best management practices employed on the project will minimize the potential for trapping small animals.
- Using spill-prevention measures to prevent inadvertent spills of fuel, oil, hydraulic fluid, antifreeze, and other toxic chemicals that could affect wildlife. As required by law, prepare and implement a hazardous spill plan or Spill Prevention Contamination Containment plan, whichever is appropriate
- Discouraging construction personnel at work sites from providing a source of human food to wildlife, avoiding habituating of wildlife and increased human/wildlife conflicts. (Title 36, Code of Federal Regulations, Chapter 1, Section 2.10(d) prohibits anyone from leaving food unattended or stored improperly where it could attract or otherwise be available to wildlife. Title 36, CFR, Chapter 1, Section 2.14(a) prohibits the disposal of refuse in other than refuse receptacles. Title 36, CFR, Chapter 1, Section 2.2(a)(2) prohibits the feeding and molesting of wildlife.)
- Maintaining proper food storage, disposing of all food waste and food-related waste promptly in a bear-resistant receptacle, and removing all garbage off site at the end of each working day.
- Placing rock barbs from outside the wetted channel. Rock would be placed in the channel using heavy equipment from the road or bank above the ordinary high water mark.
- Conducting surveys for aquatic species prior to removal of large woody debris from the tops of logjams.
- Obtaining single pieces of large woody debris only from above the high water mark in a manner that would not destabilize the logjam.

- Using intake screening devices to draw water from near the surface of fast-moving water habitats to avoid impacts to aquatic organisms during water withdrawal.
- Employing, monitoring and maintaining erosion control measures at construction locations to minimize sediment inputs to aquatic habitats.
- Engineering road stream crossings to facilitate aquatic organism passage and to maintain ecological connectivity.

## Cumulative Impacts

Similar to other protected areas, the combined effects of development in Lake Chelan NRA and in the surrounding area over time coupled with the purposeful eradication of predators through the mid-1900s have contributed to low-level or extirpated wildlife populations of some key species (gray wolf, grizzly, lynx, wolverine) in the area. The North Cascades region as a whole, however, contains most of its historic species, although in diminished numbers. Past and reasonably foreseeable NPS development projects, such as additional construction of visitor and administrative facilities, would result in additional negligible to minor cumulative effects to wildlife. The effects of existing development and hunting continue to affect wildlife. Based on analysis of WDFW data, among the species that continue to be hunted or trapped in or near Lake Chelan NRA include: large numbers of cottontail, quail, chukar, ducks, and dove; small to moderate numbers of showshoe hare, snipe, pheasant, goose, deer, bobcat, otter and low levels of turkey, jackrabbit, elk, mountain goat, bear, and cougar (Christophersen 2009). Development within the lower 12 miles of the Stehekin River has remained at a relatively low level. Extensive wilderness areas are located immediately adjacent to the Lower Stehekin Valley and within Lake Chelan NRA. The Stephen Mather Wilderness Area, for example, contains almost 635,000 acres. As a result, there is a considerable amount of protected fish and wildlife habitat. The existence and continued maintenance of the road and public and private developed areas under Alternatives 1 - 5 would continue to contribute to long-term minor to moderate cumulative adverse effects on wildlife, increasing some species while decreasing the presence of others. Other projects would also continue to have primarily short-term negligible to moderate impacts, with some minor to moderate long-term impacts, on wildlife where new development occurs. Because the proposed actions under Alternatives 1 and 4 would not result in major changes to the road location or width, these would contribute localized negligible to moderate short-term adverse effects from noise and activity, negligible to minor beneficial effects from habitat restoration (Alternative 4), and localized negligible to minor short- and long-term adverse effects from construction in undisturbed areas along the road or in areas that have recovered from the disturbance associated with original road construction. By contrast, Alternatives 2, 3 and 5 would disturb a new area for the road reroutes and would have both greater adverse impacts from habitat modification and greater beneficial effects from restoration than Alternative 1. Alternative 5 would also disturb new areas for the Reroute Access Connector. Restoration benefits would be similar among all action alternatives (2 - 5), primarily because of replacement and relocation of the housing and maintenance complex and actions at Lower Field and Buckner Homestead lower hayfield and pasture. These benefits would be greater under Alternatives 2, 3 and 5 because more rerouted road would be restored; however, adverse effects from construction of the reroute(s) would also be greater under Alternatives 2, 3 and 5.

Other past, present, or future actions have the potential to cause additional impacts to wildlife. In the Stehekin Valley, these impacts are mostly the result of construction-related activities (principally associated with roads in the project area) and from the Forest Fuels Reduction

Program. The Forest Fuels Reduction Program would continue to have short- and long-term adverse impacts on wildlife, including from the presence of fire, smoke, and human activity. Wildlife is likely to avoid areas while fires are occurring, and some species may relocate permanently following habitat changes after fires. Long-term benefits from the reintroduction of fire and selective thinning would include a reduction in tree diseases and insect infestation, prevention of crown (tree canopy) fires, understory growth enhancement by reducing shade, and improvement to the overall structure of the forest (i.e., maintaining a late successional stage forest). Short term, habitat changes can adversely impact some wildlife species, while benefitting others. In the long term, however, fire can create a more diverse vegetation pattern that supports greater wildlife diversity, and protects habitat stability by reducing the potential for a very hot and destructive fire.

In addition, park actions associated with new construction often result in the removal of snags, which are favored by many wildlife species. As a result, ongoing impacts from snag removal near new construction would continue to have negligible to minor localized adverse impacts.

The increase in the number of barbs and other erosion protection structures over time in the Stehekin River has contributed to minor to moderate localized cumulative adverse effects on the diversity, abundance, distribution, and quality of aquatic habitat in the Stehekin River. Negligible to minor adverse effects have been contributed by snowmelt culverts and side-channel culverts. Alternatives 2 - 5 would contribute localized negligible to minor beneficial and adverse effects on wildlife, with Alternative 4 having comparatively the greatest contribution to adverse impacts from the largest number of bank structures. Alternative 1 would also likely have cumulative adverse impacts that would be similar to Alternative 4 since over time, there would be a need for more (and piecemeal) bank stabilization measures to retain the Stehekin Valley Road in place.

When added to the impacts of other development in the lower Stehekin Valley, Alternative 1 would contribute minor cumulative adverse effects on wildlife, primarily from habitat disturbance, while Alternatives 2, 3 and 5 would contribute minor to moderate adverse effects, primarily from habitat removal due to the reroutes, and Alternative 4 would contribute minor to moderate cumulative adverse effects, again primarily due to habitat disturbance. Minor to moderate cumulative beneficial effects would occur from the restoration of wildlife habitat in all alternatives.

## Conclusion

Impacts on wildlife from Alternative 1 would be minor to moderate, short- and long-term, and both beneficial and adverse from rehabilitation of the Stehekin Valley Road, implementation of portions of the Road Improvement Project and construction of the Lower Valley Trail, and replacement and relocation of the maintenance facility and housing. Alternative 1 would contribute localized minor cumulative adverse effects primarily due to habitat disturbance. In Alternative 2, adverse impacts would range from short- to long-term and negligible to major, while beneficial impacts associated with removal of the road from the floodplain would be moderate and would somewhat offset impacts from the reroute. Alternative 2 would contribute localized moderate to major adverse cumulative impacts and localized minor beneficial impacts on wildlife. Alternative 3 impacts would be similar to those under Alternative 2, with negligible to major adverse impacts (primarily related to wildlife disturbance and habitat loss) and long-term negligible to moderate localized beneficial effects from restoration. Compared to Alternative 2, both adverse and beneficial effects would be somewhat less due to shorter reroute and less potential restoration at Lower Field. In Alternative 4, fewer overall beneficial effects would occur compared to Alternatives 2 and 3 because the road would be retained in the channel migration zone and it is likely that over time, additional erosion protection measures and/or eventual relocation would be needed that would cause long-term adverse effects on wildlife. Adverse effects from Alternative 4 would be short and long term and minor to moderate. Alternative 5 would have impacts similar to Alternative 2, with localized moderate to major adverse cumulative impacts and localized beneficial impacts. Compared to Alternative 2, impacts in Alternative 5 would include additional road construction.

Although localized impacts would range to major in Alternatives 2, 3 and 5 due to the disturbance of approximately 13 acres of wildlife habitat from the construction of the reroutes, no species loss would occur and displaced species could use other nearby intact areas and adjacent future restored areas for habitat.

## 10. Special Status Wildlife Impacts

### Special Status Wildlife Methodology

Special status wildlife impacts are formally determined under the Endangered Species Act (Section 7). Analysis was based on the known or likely occurrence of the species in the vicinity of the project area and the potential loss or alteration of habitat and potential effects to the species.

**Context of Impact:** Special status wildlife impacts were considered in the lower Stehekin Valley within the nonwilderness portion of Lake Chelan NRA and within the region.

**Type of Impact:** Adverse impacts are those that would alter the range, location, number, or population of a species and/or its habitat. Beneficial impacts would expand, improve, or protect one or more of these characteristics.

**Intensity of Impact**:

- **No Effect:** The project (or action) is located outside suitable habitat and there would be no disturbance or other direct or indirect impacts on the species. The action will not affect the listed species or its designated critical habitat.
- **May Affect, Not Likely to Adversely Affect:** The project (or action) occurs in suitable habitat or results in indirect impacts on the species, but the effect on the species is likely to be entirely beneficial, discountable, or insignificant. The action may pose effects on listed species or designated critical habitat but given circumstances or mitigation conditions, the effects may be discounted, insignificant, or completely beneficial. Insignificant effects would not result in take. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects or (2) expect discountable effects to occur.
- **May Affect, Likely to Adversely Affect:** The project (or action) would have an adverse effect on a listed species as a result of direct, indirect, interrelated, or interdependent actions. An adverse effect on a listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions and the effect is not: discountable, insignificant, or beneficial (USFWS 1998).

## Special Status Wildlife Impacts

### *Impacts from Actions Common to Alternatives 1 - 5*

Most special status wildlife would remain unaffected by proposed actions. Because there would be habitat loss, however, analysis has resulted in the following determinations of effect (in compliance with Section 7 of the ESA) for listed and proposed species for Alternatives 1 - 5. Some adverse impacts would be mitigated by restoration of riparian areas. Where impacts would be different among alternatives, these are noted below. In addition to specific effect analyses below, the general impacts identified in the "Wildlife Impacts" section would also affect special status species and are the basis for the summary of impacts in this section.

The USFWS issued a letter indicating concurrence with the determinations of effect for the following listed species on March 10, 2010 (informal consultation): the USFWS concurred with the NPS determination of "may affect, not likely to adversely affect" for bull trout (*Salvelinus confluentus*), Canada lynx (*Lynx canadensis*), gray wolf (*Canis lupus*), and grizzly bear (*Ursus arctos*) (USFWS reference: 13260-2010-1-0037). The biological opinion (BO) for formal consultation associated with the northern spotted owl is dated July 12, 2010. As noted in the BO, "The attached Biological Opinion (BO) describes the effects of the Project on the northern spotted owl (*Strix occidentalis caurina*). The Service concludes in the attached BO that the implementation of the Project is not likely to jeopardize the continued existence of the northern spotted owl. The attached BO completes consultation on the Stehekin River Corridor Implementation Plan."

#### Federally Listed and Proposed Species

**Gray Wolf:** Since wolves tend to avoid human activity areas and because habitat for gray wolves is common in the surrounding area, adverse impacts on gray wolves would be short term and negligible and related to noise and activity from construction. There would be no major increase in the amount or type of human activity following construction. Because no denning or foraging habitat would be removed, there would be no cumulative effects on gray wolves. Proposed actions under Alternatives 1 - 4 may affect, but would be not likely to adversely affect gray wolves.

**Grizzly Bear:** Adverse impacts to grizzly bears would be short term and negligible, since the area of disturbance is small and grizzly bears tend to use higher elevations in summer (during the period when construction is planned) and are less likely to be in the area at that time. There would be no major increase in the amount or type of human activity following construction. Proposed actions under Alternatives 1 - 5 may affect, but would be not likely to adversely affect grizzly bears.

**Canada Lynx:** Although project area lands generally do not comprise suitable habitat, Canada lynx may occur in the area, but would tend to avoid the area during construction. Since the area of disturbance is small compared to the available habitat beyond the project area in surrounding national forests and North Cascades National Park, impacts would be negligible. There would be no major increase in the amount or type of human activity following construction. Proposed actions under Alternatives 1 - 5 may affect, but would be not likely to adversely affect Canada lynx.

**Pacific Fisher:** Fishers have not been found in the Stehekin Valley since 1980. Prior to that, fishers were found in North Cascades NPS Complex in areas of Douglas-fir and grand fir above

1,800 feet amsl. Because the project area is entirely below the 1,640-foot contour in the lower Stehekin Valley, proposed actions in Alternatives 1 - 5 may affect, but would be not likely to adversely affect this species. Negligible beneficial effects would occur from removing a portion of the Stehekin Valley Road away from riparian habitat (including the channel migration zone) in Alternatives 2, 3 and 5 and from long-term actions that could protect lands within McGregor Meadows if exchanges occurred. Long-term minor adverse effects coupled with long-term negligible beneficial effects would occur. Alternatives 1 and 4 would be more likely to contribute adverse effects and less likely to contribute beneficial effects due to the retention of the road.

**California Wolverine:** Recent research (K. Aubrey, pers. comm.) and incidental observations (NOCA wildlife database) have confirmed wolverine presence in the Stehekin Valley over the past three years. Data obtained from radio-collared wolverines show the Stehekin Watershed to be a part of at least three separate animals' home ranges (Raley, pers. comm., 2009; Rohrer et al. 2008). Wolverines likely move through the valley; however, they prefer more remote mountainous areas of higher elevation (the project area is entirely below the 1,640-foot wilderness contour in the lower Stehekin Valley). Proposed actions would affect a relatively small area under the Alternatives (1 - 5), compared to larger areas of better-quality wolverine habitat surrounding the Stehekin Valley. Proposed actions under Alternatives 1 - 5, may affect, but would be not likely to adversely affect wolverine.

**Bald Eagle:** Because most project actions would occur in summer, outside the eagle nesting period, and would occur more than 300 feet from known nesting areas near the head of Lake Chelan, there would be minor disturbance effects to nesting eagles and to eagles that forage along the Stehekin River during the late summer and early fall (when the construction and repair work would occur). Actions at Weaver Point and near the river mouth would have the greatest potential to affect bald eagles through noise and activity. Potential eagle disturbance could also occur anywhere along the Stehekin River where construction actions are proposed, including at Boulder Creek, Milepost 3.8 (Frog Island), and Milepost 5.3 (Wilson Creek) and along the Company Creek Road. Because there would be few large trees removed and because eagles are not known to nest in other areas along the river, there would be a potential for negligible to minor short-term adverse impacts on bald eagles. Proposed actions may affect, but would be not likely to adversely affect Bald Eagles.

**Northern Spotted Owl:** The proposed project area in all alternatives is within the activity area of a pair of northern spotted owls whose nest was first detected in 1998. This nest produced at least five young in ten years. The nest activity area was occupied by barred owls during the 2008 and 2009 nesting seasons, but in spring 2010, a single male northern spotted owl was detected, but no nest or female owl were observed.

Construction of a portion of the proposed action under all alternatives would occur within the activity area where the most recent nesting activity occurred (in 2007). Annual surveys would be performed by qualified NPS staff. Should active nesting be detected in the project area, no construction may occur within 0.7 mile radius of the active nest until the young have fledged (approximately March 1 - September 6). If no active nesting is detected in the area, construction may begin July 1. Regardless of whether there is active nesting in the project area, there would be the potential to disturb foraging northern spotted owls throughout the construction season. As a result, short-term adverse impacts from disturbing the birds during construction could occur at other times.

As part of the road rehabilitation design, no pullouts would be used or tree removal would occur within the area along the road immediately adjacent to the current northern spotted owl activity area. This is to reduce the potential that Lake Chelan NRA visitors would notice the nesting owls (i.e., potentially harass the birds) or that the owls would be attracted to people or vehicles. Pullouts, if found within line of sight (0.25 miles) adjacent to the current spotted owl nest activity area would be temporarily closed during the nesting season.

Effects would occur in Alternatives 1 and 4 from disturbance and some habitat modification of 7.5 acres of northern spotted owl habitat. Habitat modification in Alternatives 2, 3 and 5 would also have long-term effects on approximately 13 acres of northern spotted owl habitat from the reroute.

The U.S. Fish and Wildlife Service (USFWS) estimates that spotted owls require an average minimum of 6,657 acres of suitable habitat per nesting pair in this part of the North Cascades. Suitable habitat surrounding the most recent nest activity area is comprised of approximately 978 acres (within a 1.82-mile radius), and 176 acres within the 0.7-mile-radius core area.

Therefore, the loss of from 7.5 acres (Alternatives 1 and 4) to 13 acres (Alternatives 2, 3 and 5) coupled with disturbance effects comprising a maximum of approximately 23 acres from proposed actions in Alternatives 2, 3 and 5 may affect and would be likely to adversely affect this pair of northern spotted owls. With 13 acres of habitat loss, Alternatives 2, 3 and 5 would impact an estimated 1.7 percent of the suitable habitat in the area, including areas within 200 - 800 feet of the customary nest activity areas.

In addition, some long-term negligible to minor beneficial effects on northern spotted owls could occur from creation of additional foraging area in restored riparian areas in Alternatives 2 - 5 and restored roadway in Alternatives 2, 3 and 5. Most effects of the alternatives, however, would be long-term moderate to major adverse impacts associated with habitat removal and short-term negligible to moderate adverse impacts associated with noise and activity during construction. Based on the BO, the USFWS has discounted these disturbance (noise) effects. Impacts to forest/road areas (edge effects) would also likely favor barred owls over northern spotted owls.

*Conclusion (Alternatives 1 and 4):* Proposed actions under Alternatives 1 and 4 may affect and would be likely to adversely affect northern spotted owls. These two alternatives implement the Road Improvement Project actions previously analyzed in a Biological Opinion on the EA for that project (see mitigation measures included below). Although most vegetation removal would be associated with construction of pullouts and new side ditches along the edge of the existing Stehekin Valley Road, these activities would occur within existing northern spotted owl habitat, affecting 7.5 acres.

*Conclusion (Alternatives 2, 3 and 5):* Alternatives 2, 3 and 5 may affect and would be likely to adversely affect northern spotted owls due to the loss of or construction disturbance impacts on approximately 13 of 133 acres of northern spotted owl habitat from the reroutes. These impacts are in addition to habitat loss due to the construction of new pullouts and additional disturbance related to rehabilitation of the Stehekin Valley Road before and after the reroute. As noted in the BO,

> *"the Project will result in approximately 24.5 acres of overall disturbance within northern spotted owl habitat, including 12.8 acres of habitat removal from the permanent removal of vegetation within the road prism and the short-term*

*impacts associated with construction (e.g., noise, human presence, staging areas for equipment). Disturbance effects are anticipated to be discountable. Based on the analysis presented in this Biological Opinion, Project effects are minor in terms of habitat impacts. Since effects at the Project scale appear to be minor, effects at the province or rangewide scales may not be measurable."*

**Fish (Bull Trout, Dolly Varden, Chinook, Westslope Cutthroat Trout):** Bull Trout have not been documented in the Lake Chelan watershed since 1957, when two "Dolly Varden" were caught and sent to Oregon State University (Nelson 2012). As noted in Chapter III: *Affected Environment*, Dolly Varden do not actually occur in the Lake Chelan watershed. The USFWS, however, is considering their reintroduction (NPS NOCA 2008:173) and the NPS manages the Stehekin River corridor as if they were present. Surveys conducted in 2010 and 2011 documented the presence of adult and juvenile cutthroat trout in the lower reaches of the Stehekin River (Anthony, unpublished data).

The proposed actions under Alternatives 1 - 5 would result in instream work to construct barbs and logjams and to replace or construct road stream crossings. This would convert up to about 8,000 square feet of riffles to pool habitat in Alternatives 2 and 5, 4,000 square feet in Alternative 3, and up to 17,000 square feet in Alternative 4. There would be no additional pool habitat in Alternative 1. In addition, two logjams in Alternatives 2 - 5 could have long-term minor to moderate adverse and beneficial effects on fish habitat. Slope stabilization at Milepost 5.3 (Wilson Creek) and at Milepost 8.0 would occur above the ordinary high water mark. Work in or near water includes constructing bank barbs, logjams, slope stabilization, bioengineering, and riparian restoration. In addition to clearing and grading, these activities would have the potential to cause an increase in the amount of sediment in the water. Increased sediment load and short-term turbidity can adversely affect fish, as described in the "Wildlife" section above.

To reduce or eliminate impacts, BMPs such as temporary erosion and sediment control, including silt fencing, would be used. Revegetation of disturbed areas would protect soils from erosion and reduce the potential for erosion of and long-term impacts to stream habitat. In addition, moving the Stehekin Valley Road away from the river in Alternatives 2, 3 and 5 would have long-term beneficial effects by allowing additional area for natural river processes within the 100-year floodplain and channel migration zone, which could improve local habitat for fish. Proposed actions under all alternatives may affect, but would be not likely to adversely affect bull trout and cutthroat trout in the project area due to the timing and locations of the construction activities and planned mitigation measures. Future potential beneficial effects could be realized from proposals to restore native cutthroat and bull trout populations in part of their historic habitat within the Stehekin drainage.

### Other Federal Sensitive Species and State-listed, Proposed and Sensitive Species

**Northern Goshawk:** Potential and occupied goshawk nesting sites would be adversely affected due to the removal of approximately 13 acres of presently undisturbed forest habitat from construction of a road reroute in Alternatives 2, 3 and 5. This proposed action under these alternatives may affect, but would not be likely to adversely affect goshawks, because a large amount of suitable goshawk habitat would remain. Removal of forested edge area adjacent to the Stehekin Valley Road in Alternatives 1 and 4 would have no effect on nesting goshawks, because goshawks nest within contiguous forest canopy areas. Goshawks flying through these areas to forage would, however, have fewer trees where these were removed for pullout construction or to realign parts of the road in McGregor Meadows under Alternatives 1 and 5.

**Western Gray Squirrel:** Western gray squirrels have been documented in the lower valley. The road reroute may affect their upland forest habitat; however the riparian zone restoration would add preferable mixed forest habitat in this area. While no specific adverse effects have been identified, the loss of additional vegetation from construction of new areas associated with road rehabilitation (Alternatives 1 - 5) and from reroute construction (Alternatives 2, 3 and 5) as well as general loss of vegetation from construction of the housing and maintenance areas could affect squirrel habitat. In general, areas where they are found would likely be avoided by project impacts under all alternatives. Because some beneficial and adverse impacts are possible, project actions under all alternatives may affect, but would be not likely to adversely affect squirrels.

**Western Toad, Cascades Frog, Tailed Frog and Columbia Spotted Frog:** Actions that would occur in water, wetlands and riparian areas, including placement of barbs and logjams, have the potential to adversely impact amphibians. Localized short-term impacts would consist of loss of individuals or dewatering habitats during vulnerable stages in amphibian development. Long-term broader scale impacts could occur from sedimentation, habitat fragmentation and alterations of flow regimes in first and second order tributaries. Long-term beneficial effects, including a long-term potential improvement in amphibian habitat, could occur as a consequence of streambank revegetation and a return to natural floodplain hydrology. These would be greater in Alternatives 3 and 4, than Alternatives 2 and 5, and least in Alternative 1. Overall, the alternatives would result in short-term negligible adverse effects from sedimentation and long-term beneficial effects from reduced erosion and the restoration of natural floodplain processes. Alternatives 1-5 may affect, but would be not likely to adversely affect Columbia spotted frogs due to planned mitigation measures.

**Other State-listed, Proposed, and Sensitive Species:** Proposed actions under Alternatives 1 - 5 would have no effect on the following species: Keen's myotis, golden eagle, merlin, black swift, Vaux's swift, Lewis's woodpecker, black-backed woodpecker, pileated woodpecker, common loon, and western grebe.

Generally, the rehabilitation of the Stehekin Valley Road and construction of housing and the new maintenance area would not affect birds and bats during the nesting season because it would primarily occur during nonnesting or late nesting periods (in summer) (Alternatives 1 - 5). Removal of trees from the reroute area, however, would likely commence prior to the end of the nesting season for some species (Alternatives 2, 3 and 5). To avoid adverse impacts, forested reroute areas in these alternatives would be surveyed prior to tree removal to determine the presence of nesting behavior. Short-term disturbance from construction noise and human activities associated with construction in Alternatives 2, 3 and 5 would be similar to ambient conditions elsewhere. Because the potential disturbance area is small relative to the availability of nearby foraging areas in adjacent undisturbed habitat, these impacts would be localized and negligible. Restoration impacts, primarily under Alternatives 2 - 5, would include obliteration of some former roadway (more in Alternatives 2, 3 and 5) and restoration of some former riparian areas (Lower Field and Buckner Homestead hayfield and pasture). These actions would result in long-term negligible to moderate beneficial effects on birds from the new trees and shrubs, providing new resting and nesting areas where habitats have been affected by human activities.

**Harlequin Duck:** Where construction would occur in or near the Stehekin River, there could be adverse effects on harlequin ducks. Construction-related impacts include increased noise, dust, and human activity and temporary disturbance to riverbank habitat. Most work, however, would occur outside the breeding and nesting season for harlequin ducks (April to early July) so that adverse effects during these sensitive times would be minimized. Slight adverse impacts on foraging harlequin ducks could occur; however, there is an abundant supply of foraging habitat for this species, and they tend to start leaving the area near the end of July to return to the coast. Beneficial effects would occur from the restoration of riparian habitat in Alternatives 2 - 4 and from bioengineering in Alternatives 1 - 5. Overall effects would be minor and localized and may affect, but would be not likely to adversely affect harlequin ducks.

## Measures to Avoid, Minimize, or Mitigate Impacts

The following conservation measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to related to northern spotted owls, bull trout, and other special status wildlife species:

- Determining whether northern spotted owls are nesting, and then whether or not the proposed action will affect the active nest or disrupt reproductive behavior. If it is determined that the action will not affect an active nest or disrupt breeding behavior, work will proceed without any restriction or mitigation measure. If it is determined that construction activities will affect an active nest or disrupt reproductive behavior, then avoidance strategies will be implemented.
- If after northern spotted owl protocol surveys have been completed by July 1 in the year work is planned and occupancy has not been documented at the site (as determined by the North Cascades NPS Complex wildlife biologist), work may begin after July 1 of that year. If the site is occupied and nesting is occurring, construction activities within a 0.7 mile radius of the active nest cannot be conducted from March 1 through September 6 or after at least 4 weeks have passed since young fledged. This construction start date will be recommended by the North Cascades NPS Complex wildlife biologist and approved by the superintendent.
- Temporarily closing parking within pullouts within line-of-sight (0.25 miles) of the area along the road that is immediately adjacent to the current spotted owl nest activity area if identified.
- Placing rock barbs from outside the wetted channel. The rock would be placed in the channel using heavy equipment that will be on the road or bank above the ordinary high water line.
- Storing food and garbage in wildlife-resistant containers during the day and removing all garbage off-site from project work areas at the end of each working day.
- Surveying construction areas and removing amphibian species to avoid incidental impacts through dewatering and/or crushing.
- Constructing road stream crossings to allow for aquatic organism passage.

The following reasonable and prudent measures with respect to northern spotted owls (developed by the USFWS in the Road Improvement Project Biological Opinion [USFWS 2005]) would also be implemented as part of the project by NPS wildlife biologists:

- Monitoring project implementation to ensure compliance with the conservation measures listed above, especially the seasonal timing restrictions and the final placement of the road near the spotted owl nest and reporting the results of this monitoring to the USFWS. A North Cascades Complex biologist would monitor the spotted owl nest to determine if the spotted owls produce young during the year(s) of project implementation. (The biologist would also determine whether the spotted owl nest is occupied or has moved.) If young are discovered, then the biologist would estimate the age of the fledgling(s) as part of the timing restrictions described above.

- Reporting progress of the proposed action and its impacts on federally threatened and endangered species, particularly northern spotted owls to the USFWS as specified in the incidental take statement in the biological opinion in accordance with 50 CFR §13.45 and §18.27.
- Reporting any dead or injured Federally-listed species found in the action area within 24 hours to a special agent of the USFWS, Division of Law Enforcement at (360) 753-7764, or to the USFWS Western Washington Fish and Wildlife office at (360) 753-9440.
- Notifying USFWS in writing within 3 working days of the accidental death of, or injury to, a northern spotted owl or of the finding of any dead or injured spotted owls during implementation of the proposed federal action. Notification must include the date, time, and location of the incident or discovery of a dead or injured spotted owl, as well as any pertinent information on circumstances surround the incident or discovery. The USFWS contact for this written information is the Manager for the Western Washington Fish and Wildlife office.

In the 2010 BO, the USFWS identified the following measures (dates modified to "first year" where 2011 was used and "second year' where 2012 was used:

- Conservation measures include:
  * Align the road to avoid as many large diameter trees ("30» dbh) and those with nesting features (conifers with upper canopy crotch or mistletoe broom) as possible.
  * Complete spotted owl surveys to protocol March 1 - June 30 in the first and second years. Surveys would be completed prior to the start of construction.

If spotted owls are detected during the first set of surveys, the following measures would be implemented:

- Construction or other disturbance activities would not occur within 0.7 mile radius of the nest site during the breeding season (March 1 September 6). This applies to known all nest sites if the current year nest site location is not known.

If spotted owls are detected during the first year but not detected the second year:

- The first year, construction would begin on or after July 1 (following the 2011 surveys).
- The second year, surveys to protocol would be completed (March 1 - June 30). If spotted owls are detected, construction and disturbance activities within 0.7 miles of the nest site would not begin until after the breeding season (September 6). If spotted owls are not detected during the surveys, construction would begin once surveys are complete (July 1).

If spotted owls are not detected during surveys in the first or second year:

- Construction would begin July 1 the first year.
- Construction would begin the second year without restriction
- Monitoring by NPS biologist would continue throughout the breeding season (March 1-September 6) for the remainder of the project. If a spotted owl is detected during

monitoring, construction and disturbance activities would stop within a 0.7 mile radius of the nest site until September 6.

In addition to these Conservation Measures, Best Management Practices (BMPs) such as temporary erosion and sediment control, including silt fencing, would be used. Revegetation of disturbed areas would protect soils from erosion and reduce the potential for erosion and long-term impacts to stream habitat. In addition, moving the Stehekin Valley Road away from the river would have long-term beneficial effects on allowing additional area for natural river processes within the 100-year floodplain and channel migration zone, which could improve local habitat for fish.

## Cumulative Impacts

Over time, long-term adverse effects to special status species have occurred throughout the Cascades and Washington State. Adverse impacts have been associated with development, predator control, unnaturally frequent wildland fire, and habitat fragmentation, primarily from transportation corridors, housing and commerce. Effects from past, present, and future actions occurring within Lake Chelan and the surrounding national forests and the NPS Complex would continue to be primarily from administrative and private development in areas in close proximity to where it has already occurred. Ongoing actions to repair and maintain administrative facilities, including roads, bridges, housing, and visitor and maintenance facilities, would continue to occur and would continue to have negligible to minor incremental adverse cumulative effects on special status species. As noted in the "Impacts to Wildlife" section above, ongoing impacts from the Forest Fire Fuel Reduction Program would continue to have both general wildlife impacts as well as potential impacts on special status species. A biological opinion for the program guides its implementation with respect to these impacts, allowing for some adverse effects on northern spotted owls based on a determination of may affect, likely to adversely affect. Similarly, a biological opinion covered the actions that would be implemented by the Road Improvement Project as part of this plan; however, a separate biological opinion has been obtained for the SRCIP FEIS (Appendix 20).

NPS actions would continue to be modified, if possible pending identification of special status species through surveys and other analysis, unless potential adverse effects are outweighed by other moderate long-term beneficial effects. In the present action, removal of development from the floodplain and channel migration zone of the Stehekin River under Alternatives 2, 3 and 5 would have a long-term beneficial effect on riparian habitat and habitat diversity.

Because they would modify nearly 13 acres of the known habitat of a currently listed species that is declining throughout its range, Alternatives 2, 3 and 5 would have moderate to major adverse cumulative effects on northern spotted owls, particularly within the project area. Alternatives 1 and 4 would modify less than ten acres and would therefore have localized moderate cumulative adverse effects on northern spotted owls, however rangewide effects were determined to be discountable by the USFWS in the BO: "Since effects at the Project scale appear to be minor, effects at the province or rangewide scales may not be measurable."

For other species, including other federally listed and proposed species, project actions would result in long-term minor cumulative adverse effects, primarily because these species would be indirectly affected by project actions (such as by the loss of perching bird habitat within the roadway alignment); because a comparatively small amount of their overall habitat would be affected (such as for medium- and large mammals and birds); or because they are not currently known from the project area (such as lynx). Exceptions would include bald eagles, northern goshawks, harlequin ducks, western gray squirrels, and riparian affiliate birds (such as the olive-sided flycatcher), where there would be some beneficial and some adverse effects. Some additional negligible to minor adverse and beneficial effects would also be contributed to cumulative effects on special status species, such as amphibians and fish, from actions which affect water flow within the Stehekin River.

Road improvements may actually result in fewer long-term impacts to some species, such as fish, frogs, and toads, particularly where the road is relocated away from the river or where improvements are made to drainage. Where the road is outside the channel migration zone and/or the 100-year floodplain (particularly through rerouting in Alternatives 2, 3 and 5), fewer road repairs and maintenance would occur in proximity to aquatic species habitat, and there would therefore be less potential for disturbance from human activity based on the proximity of the road to the habitat. In all alternatives, the installation of barbs and logjams would contribute short-term adverse impacts from construction and long-term moderate adverse impacts from changes in river processes coupled with long-term negligible to minor beneficial cumulative impacts from the creation of new habitat.

## Conclusion

Alternatives 1 - 5 may affect, and would be likely to adversely affect, northern spotted owls long-term with short-term adverse effects related to impacts from construction and long-term cumulative localized moderate to major adverse effects on habitat. According to the Biological Opinion, however, because effects at the project scale appear to be minor, effects at the province or range-wide scale may not be measurable. As a result the USFWS does not anticipate that the proposed action will jeopardize the continued existence of the northern spotted owl. Alternatives 1 - 5 may affect, but would not be likely to adversely affect, the following listed, proposed, or candidate species: grizzly bears, gray wolves, Canada lynx, Pacific fishers, and Columbia spotted frogs. Similarly, the proposed actions may affect, but would not be likely to adversely affect, the following federal species of concern: *mammals*: California wolverine, western gray squirrel, Pacific Townsend's big-eared bat, small-footed (Yuma) myotis, western long-eared myotis, fringed myotis, and long-legged myotis; *birds*: bald eagle, peregrine falcon, northern goshawk, olive-sided flycatcher, harlequin duck, and black swift; *fish*: westslope cutthroat trout; and *amphibians*: western toad, spotted frog, Cascades frog, and tailed frog.

As noted above, there would be no known effect on the following federal or state-listed, proposed, and candidate species or species of special concern: bull trout, golden eagle, merlin, Vaux's swift, black-backed woodpecker, Lewis's woodpecker, pileated woodpecker, common loon, and western grebe.

Because there would be limited major adverse impacts to threatened or endangered species or species of concern, there would be no significant impact to Lake Chelan NRA's special status species resources or values. Northern spotted owls may have become displaced from their existing nest site by barred owls prior to analysis under the proposed alternatives, or the presence of a male in May 2010 and 2011 could signal return to the nest activity area. Other northern spotted owl nest sites within the lower Stehekin Valley would likely continue to produce young. Visitors and residents would likely continue to have the opportunity to hear or to experience rare glimpses of this threatened species.

# 11. Cultural Resources

## Introduction to Cultural Resources Section

Potential impacts to cultural resources, including archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties, either listed in or eligible for listing in the National Register of Historic Places were identified and evaluated. Analyses were in accordance with the Advisory Council on Historic Preservation's (ACHP) regulations implementing Section 106 of the NHPA (36 CFR 800, Protection of Historic Properties). Analysis included (1) determining the APE, (2) identifying cultural resources present in the APE that are National Register-listed or eligible, (3) applying the criteria of "adverse effect to affected resources," and (4) considering ways to avoid, minimize, or mitigate adverse effects.

The criteria for characterizing the severity or intensity of impacts to National Register-listed or eligible archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties are the Section 106 determinations of effect: no historic properties affected, adverse effect, or no adverse effect. A Section 106 determination of effect is included in the conclusion section for each analysis of impacts to National Register-listed or eligible cultural resources.

# 12. Archeological Resources Impacts

## Archeological Resources Methodology

Archeological resources are typically considered eligible for inclusion in the National Register of Historic Places because of the information they have yielded or may be likely to yield (36 CFR 60.4). Loss of site integrity through destruction of the characteristics that contribute to eligibility may cause irreparable damage and may be considered an adverse effect. Adverse impacts to archeological resources most often occur as a result of earthmoving activities within an archeological site, soil compaction or increased erosion, unauthorized surface collection, or vandalism. Auditory and visual characteristics of undertakings can also affect historic properties.

Archeological resources impacts were analyzed qualitatively, with respect to whether or not surveys have revealed archeological information in the project area (or APE).

**Context of Impact:** Archeological resources were considered within the lower Stehekin Valley below High Bridge within the nonwilderness portion of Lake Chelan NRA and within the North Cascades National Park Complex.

**Type of Impact:** Adverse impacts would include activities involving ground disturbance (including soil compaction) in the presence of an archeological site, or activities that would increase the potential for vandalism, illegal collecting of artifacts, or destruction of a site. Beneficial impacts to archeological resources can occur when patterns of visitor use or management action are changed near archeological resources such that an ongoing impact is reduced or eliminated. Direct impacts can occur as a result of grading, trenching, or other activities that damage the structure of an archeological site. Indirect impacts can occur as a result of increasing visitor activity or management action near an archeological site, leading to effects such as artifact collection, accelerated soil compaction, and erosion. Auditory and visual characteristics of undertakings can also affect historic properties.

**Intensity of Impact:** The intensity of impacts to an archeological resource would depend upon the potential of the resource to yield important information, as well as the extent of the physical disturbance or degradation. For example, major earthmoving at an archeological site with low data potential might result in a minor adverse impact, whereas major impacts would involve archeological sites with high data potential.

Section 106 definitions:

- **No effect:** A determination of no historic properties affected means that either there are no historic properties present or there are historic properties present in the area of potential effects (APE) but the undertaking will have no effect upon them (36 CFR 800.4(d)(1)).
- **No adverse effect:** A determination of no adverse effect means there is an effect, but the effect would not meet the criteria of an adverse effect [36 CFR Part 800.5(a) (1)], i.e. diminish the characteristics of the cultural resource that qualify it for inclusion in the National Register (36 CFR 800.5(b)). The undertaking is modified or conditions are imposed to avoid or minimize adverse effects. This category of effects may have effects that are considered beneficial under NEPA, such as restoration, stabilization, rehabilitation, and preservation projects.
- **Adverse effect:** An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the National Register, e.g. diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance or be cumulative (36 CFR 800.5(a) (1)). An adverse effect may be resolved in accordance with the 2008 Programmatic Agreement, or by developing a memorandum or program agreement in consultation with the SHPO, ACHP, American Indian tribes, other consulting parties, and the public to avoid, minimize, or mitigate the adverse effects (36 CFR Part 800.6(a)). If an impact to National Register historic property cannot be resolved by agreement among SHPO, ACHP, American Indian Tribes, other consulting parties and the public it would be considered significant.

## Archeological Resources Impacts

Numerous cultural resources surveys have been conducted within the proposed APE over nearly two decades. The surveys were conducted pursuant to several types of proposed NPS undertakings, including road storm damage repair, road realignment, road resurfacing, trail construction, and fire management activities. A survey was initially conducted by Bob Mierendorf, park complex archeologist, and Ray DePuydt, Lake Roosevelt NRA archeologist, in July 2008. Later surveys were also conducted, including one in summer 2010. No cultural resources were found. Consequently, proposed road actions have been surveyed for cultural resources (Mierendorf 2009).

### *Impacts from Alternative 1*

None of the 12 pre-contact period sites identified to date within the project area are located in areas that are proposed for undertakings. No pre-contact archeological sites have been recorded in or near proposed Company Creek Road actions. As additional detailed plans and APEs for each undertaking are developed, however, no known prehistoric or historic archeological resources would be affected and the NPS would continue to comply with Section 106 of the NHPA in analyzing effects to cultural resources.

Routine, ongoing maintenance of the road prism (area affected by previous road construction activities) would not result in major changes to existing areas of disturbance. Future road failure related to flooding would have the potential to disturb previously unknown or undiscovered archeological resources, as would replacement or modification of culverts, expansion of existing developed areas, and other actions. Continued encroachment from parking in undeveloped pullouts would also have the potential to affect previously unidentified archeological resources as erosion of bare soil continued.

Approximately five to eight acres of previously disturbed land near the airstrip would also undergo soil disturbance as part of the housing and maintenance area replacement and relocation out of the floodplain in Alternatives 1-4 and some of this area plus the potential for other locations for relocation of housing in Alternative 5.

Because archeological resources have been surveyed for within the proposed project area, because archeological resources found were outside the project area, and because the discovery potential for buried archeological resources would employ mitigation measures noted below, there would be no historic properties affected.

### *Impacts from Alternatives 2 and 5*

As in Alternative 1, none of the 12 pre-contact period archeological sites is within an area proposed to be affected by the implementation of this alternative. There is one historic period site within the project area, the discontinuous segments potentially associated with the Stehekin Wagon Road (45CH429).

One other site, the Weaver Point Historic Site (45CH452) is near proposed actions but would not be affected by the implementation of Alternatives 2 or 5 because it is outside the project area. It is located at Weaver Point well away from the shoreline of either Lake Chelan or the mouth of the Stehekin River. This site is being tested as part of the Chelan PUD relicensing for the Lake Chelan hydroelectric project. The results of testing will determine appropriate management action as part of the FERC relicensing agreement. In the erosion protection component of the license, the southwest-facing area would be treated with a logjam and rock wall along approximately 500 feet at Weaver Point to prevent shoreline erosion from occurring where the lake intersects the bank. Access to the area (from the water) to implement these actions would not affect the archeological site. Since neither access nor implementation of proposed actions would occur near the historic archeological site and instead would occur along the edge of the lake / mouth of the Stehekin River outside the site's boundary, there would be no historic properties affected.

Construction of the reroute would likely not affect three closely spaced rock wall segments built on the downhill side of an abandoned roadbed (a segment of 45CH429) where it traverses the sloping toe of a large boulder-strewn debris cone. These rock walls would be avoided. This portion of site 45CH429 that would be affected by Alternatives 2 and 5 has been informally assessed as ineligible for the National Register. Based on archeological analysis, the features appear to lack integrity of association and workmanship; their age and affiliation with an original or early Stehekin Valley Road cannot be demonstrated; and they do not represent the best example of early road design and construction techniques in the lower valley (Mierendorf 2009). Nonetheless, as a historic archeological feature, they would be documented using Historic

American Engineering Record (HAER) criteria if they would be affected by road construction, and concurrence from the State Historic Preservation Officer (SHPO) regarding their proposed disposition would be sought as required by the NPS programmatic agreement (NPS et al. 2008).

As noted above in Alternative 1, archeological surveys have been conducted in areas associated with proposed actions in Alternative 1 and/or would be conducted and/or soil-disturbance activities would be monitored. In addition, archeological surveys of the proposed land exchange properties were also conducted (Mierendorf 2009). With the exception of the McGregor Meadows actions, those actions identified above would also be part of Alternatives 2 and 5. Therefore, in addition to those areas identified above, soil disturbance would occur in the following areas: below Boulder Creek; along the Stehekin Valley Road at Milepost 3.8 (Frog Island), Milepost 8.0, and Milepost 9.2; for the McGregor Meadows / Lower Field reroute and McGregor Meadows Access Road; at Purple Point, Rainbow Falls, and near Bullion Raft Launch; near the mouth of the Stehekin River; at Lower Field and Buckner Homestead hayfield and pasture; and on proposed land exchange properties. Approximately 5 acres of previously disturbed land near the airstrip would also undergo some soil disturbance as part of the housing and maintenance facility replacement and relocation out of the floodplain. Under Alternative 5, it is also likely that housing replacement would occur elsewhere in the lower valley.

Alternative 5 would also include actions between the McGregor Meadows Access Road and the proposed reroute (for the Reroute Access Connector).

Because no known National Register eligible archeological resources are found in these areas and known archeological resources are outside the proposed areas that would be affected by the implementation of this alternative, and because the discovery of potential buried archeological resources would employ mitigation measures noted below, there would be no (known eligible) historic properties affected.

### *Impacts from Alternative 3*

Although Alternative 3 would include one additional erosion protection measure (at Lower Field) and one additional camp, along with a shorter reroute, effects on archeological resources would be the same as described in Alternative 2: no historic properties affected.

### *Impacts from Alternative 4*

Impacts from Alternative 4 on archeological resources would be the same as described in Alternative 1: no historic properties affected.

## Measures to Avoid, Minimize, or Mitigate Impacts

Based on the NPS *Programmatic Memorandum of Agreement with the Association of State Historic Preservation Officers and the Advisory Council* (NPS et al. 2008), the following measures would be included in the proposed project to minimize impacts to archeological resources:

- Documenting the rock walls along the reroute (Alternatives 2, 3 and 5) using HAER criteria if these would be affected by proposed road construction.
- In the event of inadvertent discoveries during implementation of projects, the park Superintendent would consult with the SHPO/THPO and federally recognized Indian Tribes

(as appropriate) as soon as possible. The policy in such cases is to halt any additional work at the discovery location and to notify cultural resources staff immediately. Until the discovery can be documented by professionals with appropriate expertise, it would be secured and all disturbance would be avoided. In compliance with the NHPA and other applicable statutes, the discovery would be assessed for its eligibility for the National Register of Historic Places.

- In the event that human remains are discovered during implementation of any project, the park Superintendent would consult with the SHPO/THPO and federally recognized Indian Tribes as soon as possible. The policy in such cases is to halt any additional work at the discovery location and to notify cultural resources staff immediately. The location and its immediate vicinity would be secured, all disturbance will cease, and the find would be covered and protected until the presence of human remains can be confirmed. Human remains would be managed in compliance with the NAGPRA and ARPA.
- Determining if a monitoring plan is needed pending final construction plans and the potential to affect cultural resources.
- Monitoring would be focused where buried historical deposits are likely to be present beneath existing development. The NPS archeologist would assess the eligibility of any sites prior to construction.

### Cumulative Impacts

Prior to the advent of archeological resources protection laws, archeological resources in the lower Stehekin Valley and elsewhere in the park complex have likely been adversely impacted to varying degrees from past construction-related disturbances, visitor impacts, vandalism, and erosion and other natural processes. Because mitigation measures would be employed to minimize impacts to potentially unidentified cultural resources in other proposed and future projects, it is likely that these measures would protect archeological resources from additional impacts. There would be no construction-related impacts that would affect eligible archeological resources and therefore no cumulative impacts from Alternatives 1 - 5. There is a slight possibility, however, that future proposed work would affect currently unidentified cultural resources. Because, however, there are no direct effects to eligible properties that would occur in the proposed project that would be considered cumulative with other past, present and future actions, no further cumulative effects analysis is warranted. Because mitigation measures would be implemented as noted above, Alternatives 1 - 5 would not be expected to contribute to cumulative effects on archeological resources.

### Conclusion

Alternatives 1 - 5 would have no effect on known eligible archeological resources. No historic properties would be affected.

## 13. Cultural Resources: Cultural Landscapes Impacts

### Cultural Landscapes Methodology

Historic buildings and structures and cultural landscape impacts were analyzed qualitatively, in accordance with 36 CFR 800 criteria of effect, based on their presence in the project area and the modifications that would be made to character-defining features (features that qualify the structures or landscapes for inclusion in the National Register). Historic structures and landscapes for which a determination of eligibility has not been completed were also considered eligible.

**Type of Impact:** Impacts to cultural landscapes result from physical changes to contributing characteristics of a resource or its setting. Adverse impacts result when effects of the proposed action diminish the characteristics which make the structure or landscape eligible for the National Register or which diminish the overall integrity of the landscape (see "Methodology" section for more information). Beneficial impacts can occur as a result of restoration or rehabilitation of resources or removal of incompatible or noncontributing facilities. Direct adverse impacts generally occur as a result of modifying a significant characteristic of a historic structure or landscape resource; removal of a significant structure or landscape resource; or addition of new, incompatible facilities in proximity to a historic site or structure. Indirect adverse impacts can also occur following project completion. These impacts are generally associated with changes in historic vegetation or continued deterioration of historic structures.

**Duration of Impact:** Impacts to historic structures and cultural landscapes are considered short term if they involve activities such as temporary removal of vegetation or other contributing resources, road closures, or prescribed burns, where the impacts are noticeable for a period of 1 to 5 years. Other short-term impacts to historic structures include constructing scaffolding surrounding a building during rehabilitation work, or minor deterioration in historic fabric that is repairable as part of routine maintenance and upkeep. Long-term impacts usually last longer than 5 years but may include reversible changes to a contributing characteristic of a historic structure or landscape, such as alteration of historic appearance. Long-term adverse impacts to a historic structure or landscape resource include reversible and irreversible changes in contributing characteristics, such as loss or removal of historic fabric; other changes to the historic character of a property; demolition of a historic structure; construction of an incompatible addition or adjacent facility; or removal of a structure from its historic setting.

**Intensity of Impact:** See "Intensity of Impact" Cultural Resources in "a. Archeological Resources Methodology."

## Cultural Landscape Impacts

### *Impacts from Alternative 1*

None of the three cultural landscapes within the project area—the Golden West Lodge Historic District, Buckner Homestead Historic District, and High Bridge Ranger Station Historic District—would be affected by actions proposed in Alternative 1 (no historic properties affected).

### *Impacts from Actions Common to Alternatives 2 - 5*

The Buckner Homestead Historic District would be affected by proposed actions in Alternatives 2 - 5 to restore natural riparian conditions at the Buckner Homestead lower hayfield and pasture.

Of the following characteristics associated with cultural landscapes: spatial organization, circulation, topography, vegetation, structures, and buildings (see Chapter IV: *Environmental Consequences*—Cultural Landscapes), only vegetation would be affected by proposed actions in Alternatives 2 - 5. There would be no effect on spatial organization, circulation, topography, structures, or buildings. Vegetation restoration, however, would result in long-term beneficial effects from slowing erosion at Buckner Homestead Historic District. This action would help to retain not only the hayfield and pasture, but also other features associated with the site, including the homestead.

To prevent additional erosion of the Stehekin River bank adjacent to the hayfield and pasture, under Alternatives 2 - 5 approximately 500 feet of bank, for a width of about 30 feet (0.34 acre), would be planted with native riparian plants. This would have a long-term minor beneficial effect on the cultural landscape associated with the Buckner Homestead Historic District because the riparian edge that formerly existed along the hayfield and pasture has been lost due to erosion of the Stehekin River bank. Restoration would help to retain land that is protecting other features associated with the cultural landscape. As a result, Alternatives 2 - 5 would have no adverse effect on the Buckner Homestead Historic District.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to cultural landscapes would include the following:

- Implementing appropriate measures under "Cultural Resources: Archeological Resources."
- Ensuring that access to the Buckner Homestead hayfield and pasture would be via existing roads and paths.

Photo 32 – Stehekin River at high spring flow near Frog Island (Stehekin Valley Road is located at base of steep cliffs, about 20 feet from the eroding bank).

## Cumulative Effects

Although over time, portions of the area's cultural landscapes have likely been lost (such as some historic homes and the Fields Hotel), since establishment of Lake Chelan NRA, NPS actions to identify and to designate these areas has had a long-term beneficial effect on preserving the intact characteristics associated with them. For each of the cultural landscapes, a cultural landscape inventory has identified remaining features and whether they continue to contribute to the historic significance of the area. As a result, preservation techniques have become focused on those character-defining features which contribute to the area's significance. Although all three cultural landscapes are historically based, some of their components are related to prehistoric resources. In time, additional cultural landscapes may be designated within the lower Stehekin Valley and/or the park complex as more information is acquired and lands are evaluated, a cumulative beneficial effect. Actions in Alternative 1 would have no contribution to cumulative effects on cultural landscapes. Alternatives 2 - 5 would contribute long-term beneficial effects (no adverse effect).

## Conclusion

Under Alternative 1, there would be no historic properties affected. Alternatives 2 - 5 would have long-term beneficial effects (no adverse effect) on rehabilitation of the cultural landscape at Buckner Homestead Historic District from vegetation restoration of the riparian edge along the pasture and hayfield.

# 14. Visitor Experience

## Visitor Experience Methodology Overview

Impacts on visitor experience have been assessed using professional judgment to analyze the effects of actions on the activities of different visitor populations and different aspects of visitor use.

**Type of Impact:** Impacts on visitor experience may occur as a result of changes in road circulation, interpretation, interpretive media, campgrounds, trails, and other facilities and resources that contribute to the type and quality of visitor experience in Lake Chelan NRA. Impacts may also occur from direct actions altering the availability of a specific experience or activity. Visitor experience is also directly affected by actions influencing natural resources, such as air quality, scenic resources, and cultural resources. For example, the experience of a scenic view that is lost on a cloudy or hazy day may diminish the overall experience of a visit to an area that focuses on the view, such as from a wayside exhibit or a vista point. The extent of enhancement or degradation of natural and cultural resources, including air and water quality, the presence of vegetation (such as flowers in spring) or wildlife, and other resources (such as the experience of an excavated and interpreted archeological site or intact historic structure), also enhances or degrades the quality of the visitor experience. Beneficial impacts would enhance visitor participation and visitors' ability to connect with resources, the quality of visitor experience, and the kinds of opportunities available for visitors, including scenic resources and safety. Adverse impacts would reduce the number and/or quality of these experiences.

**Intensity of Impact:** This is identified separately below for each of the following categories of visitor experience: access and transportation, interpretation and education, visitor use opportunities, safety, and scenic resources.

## 15. Visitor Experience: Access and Transportation Impacts

### Access and Transportation Methodology

Methodology would be the same as "Visitor Experience."

**Type of Impact:** Same as "Visitor Experience."

**Intensity of Impact:**

- **Negligible:** Impacts would be imperceptible or not detectable.
- **Minor:** Impacts would be slightly detectable or localized within a relatively small area.
- **Moderate:** Impacts would be readily apparent over a large area.
- **Major:** Impacts would be substantial, highly noticeable changes in ease of access and transportation.

### Access and Transportation Impacts

#### *Impacts of Alternatives 1 - 5*

Transportation of Materials and Supplies

There would be negligible to minor short-term adverse impacts on visitor and resident access and transportation in the lower valley from transportation of materials and supplies for proposed projects under all alternatives. Under all alternatives, particularly Alternatives 1 and 4, there would be an increase in the number of barge loads for several years following approval of proposed actions. These would include transportation of people and construction materials for the maintenance and housing areas and surfacing materials for the road.

In general, it is likely that most visitors would be unaffected by the increase in barge and truck traffic, especially because it would occur over time as the proposed projects were implemented. Visitors and residents would be impacted by truck traffic on the road during weekday business hours and at other times as approved by the superintendent. Road construction would generally occur in summer and fall over approximately two years. This would be followed by two to three years of work to relocate the housing and maintenance area. Residents, because they frequently come and go, would notice the increase in traffic more. In the first one to two years following approval, depending on the selected alternative, work would be concentrated on the road improvements and erosion protection measures, while afterwards, work would be concentrated on recreational improvements, building construction, and restoration.

Both residents and visitors would experience localized minor to moderate short-term adverse impacts from traffic delays related to construction, particularly from road rehabilitation actions during construction. Residents and visitors would notice a substantial increase in the number of dump truck loads of materials traveling on the Stehekin Valley Road, under all alternatives, with 550 - 1000 trips projected. Because of the number of dump truck loads that would be required to transport fill materials, these impacts would likely be greatest under Alternative 5 (1000 truck loads), Alternative 2 (950 truck loads), Alternative 3 (900 truck loads) and least under Alternatives 1 and 4 (500-550 truck loads); however, impacts of construction at Wilson Creek (all alternatives) and Milepost 8.0 (Alternatives 2 - 5) would also result in impacts and traffic delays. In all, it is likely that there would be approximately 15-20 trips per day to unload imported material from the barge. As a result, impacts on visitor and resident access and transportation could be moderate to major.

As a result of the road rehabilitation, residents and visitors would encounter one-lane road closures with construction delays of up to 20 minutes during the week. (Although technically the road is one lane, in many places it is wide enough for two passenger cars to pass safely. It is in these wider areas where the availability of this extra space would allow "one lane" closures.) On weekends and holidays, construction would cease, except if it was associated with the reroute (off the main road) or unless approval for work on these days was granted by the superintendent. The proposed road rehabilitation under Alternatives 1 and 4 would take approximately one construction season to complete and would likely begin the year following approval of the plan. Road work under Alternatives 2, 3 and 5 would likely take two or more seasons to complete. If possible, work that would affect key visitor use areas would be scheduled before or after the main visitor use season to avoid impacts to the greatest number of people. There would be adequate notice of road closures (such as to replace major culverts) when these were necessary. Visitors and residents would be informed of construction delays through various means, including press releases to local media, Stehekin Community e-mails, notification at visitor and information centers and local businesses, and signs posted on bulletin boards in the area, at the boat dock, and on the boat.

### Road Reroute (Alternatives 2, 3 and 5)

Construction of a full road reroute under Alternatives 2 and 5 would have long-term moderate to major beneficial effects on visitor and resident access and transportation from maintaining vehicle passage through this portion of the Stehekin Valley Road around McGregor Meadows and the Lower Field. Alternative 3 would have most of the same benefits except that these would only extend to McGregor Meadows. Consequently, the portion of the Stehekin Valley Road that passes alongside the Lower Field could be affected by flooding, a long-term minor to moderate adverse effect on visitor and resident access and transportation. In addition, the proposed Reroute Access Connector in Alternative 5 would contribute additional beneficial effects on resident and utility vehicle access and transportation into McGregor Meadows by maintaining access should a lower part of the McGregor Meadows Access Road washout in future flooding.

### Road Improvements

The rehabilitation of the road would affect visitor access through a variety of means, including constructing smoother roadways, providing clearer signs, and creating more pullouts. Long-term minor to moderate beneficial impacts on visitor and resident travel on the Stehekin Valley Road under the alternatives would include the following:

- Improvements in sight distance along the road (all alternatives)

- Safer passing from adding pullouts to facilitate traffic movement (all alternatives)
- Improvements in the road that would make it less susceptible to temporary closures and flood damage (improvements associated primarily with the reroutes in Alternatives 2, 3 and 5, from the grade raise in Alternatives 1 and 4, and from erosion protection measures in all alternatives)
- Reduced probability of complete slope failure by reducing the grade of the slope below the road and improving stability of the riverbank (at Milepost 5.3, Wilson Creek) (all alternatives)
- Fewer rock falls from laying back the steepest upper part of the slope, rock scaling, and revegetation at Milepost 8.0 (Alternatives 2 - 5)
- Diminished dust and potholes and a smoother travel surface from surfacing most of the road (all alternatives)
- Improved conditions from revegetation of disturbed and abandoned sections of road (all alternatives) and where reroutes were constructed (Alternatives 2, 3 and 5).

These actions would also have short-term minor to moderate adverse impacts from traffic delays and construction noise and activity.

**Company Creek Road and McGregor Meadows:** Long-term access to and through these areas would continue to be problematic because of periodic flooding under all alternatives. Because the Company Creek Road would not be rerouted and would therefore continue to remain directly adjacent to the right bank of the Stehekin River, across from McGregor Meadows, there would continue to be long-term adverse impacts to visitors and residents living in and traveling through this area because of the potential increased magnitude and frequency of flooding. Most flooding, however, occurs during nonpeak visitation periods, and few visitors use the upper Company Creek Road. Actions taken after the 2003 and 2006 floods, including installation of three grade-control structures and four rock barbs, have stabilized the area.

Under Alternatives 1 and 4, less flooding of the road would occur in the McGregor Meadows area due to the grade raise; however, the area would continue to experience periodic flooding that would preclude transportation to and through the area. If past trends in rapid gravel deposition in the main channel continue, flooding and erosion of the road could get worse. These same impacts could also occur in Alternative 1, although to a slightly lesser degree.

**McGregor Meadows Access Road:** Alternatives 2, 3 and 5 would improve conditions for most visitors and some residents because of the reroutes; however, the McGregor Meadows Access Road would continue to be flooded and subsequent temporary closures during road repairs would be necessary. Recent improvements, including grade-control structures, above this area would continue to be maintained under all alternatives to reduce the potential for the river to cut a new channel down the road from the river bed at Milepost 6.8. Residents who live in McGregor Meadows and visitors to these areas could also experience more difficulty in access by motor vehicle, due to the reduced road maintenance. Motor-vehicle access to the river in this area would also become slightly more difficult because the road would end at the last private parcel and visitors would no longer be able to drive to some parts of the Stehekin River shoreline. Construction of the Lower Valley Trail along the roadbed would enable continued pedestrian access to the area and benefit a more serene visitor experience along the river, which could include fishing and hiking. Because of a lack of through access, residents and visitors continuing up would have to double-back at the end of the access road and retrace their path to the rerouted main Stehekin Valley Road. As a result, reduced motor-vehicle access into the vicinity of McGregor Meadows could have negligible to minor adverse impacts on some visitors. Other visitors would experience beneficial effects from reduced motor-vehicle use and the opportunity to hike in an area of former roadway. Over time, some impacts would diminish as visitors and residents adjusted to the changed road location. In Alternative 5, access would be set up via the Reroute Access Connector, to allow for continued up and downvalley access for McGregor Meadows residents if the McGregor Meadows Access Road became impassable as a route back to the Stehekin Valley Road. As a result, residents would be assured of access to homes and businesses located in this area as long as it was needed. The Reroute Access Connector would be constructed between the reroute and McGregor Meadows through public and private property.

### Recreation

**Rafting:** Barbs would continue to be submerged during high flow periods in spring and early summer when floating the river is most popular. During late summer and winter, the upper parts of barbs would likely protrude above the water surface near the bank, but would minimally affect the rafting experience nearby, similar to other natural river obstacles (NPS LACH 1997:34). The number of raft trips decreases substantially as river flows drop in late summer. In addition, eddies and pools on the downstream side of the barbs could serve as resting areas during raft trips. These effects would be moderate in Alternative 4, which has the most barbs (16-17), and minor in Alternatives 2 and 3, with less than half as many barbs. Because logjams could be a hazard to boaters, final designs for these would be approved in consultation with a consortium of river rafting guides modeled after a process used by King County. Construction of a new river access point in Alternatives 2 and 4 would result in a minor to moderate long-term benefit to access for recreational users of the Lower River and head of Lake Chelan.

**Lower Valley Trail:** In addition to the trail itself, a variety of new access opportunities would be provided by the trail. Access across the river would be shorter and more direct to Weaver Point and to the River Trail from Stehekin Landing. From the Landing, it is approximately one miles on the River Trail to Weaver Point, where a walk-in/boat-in campground is available. The Lower Valley Trail's connection with the Stehekin River Trail would also allow for a new loop trail opportunity (approximately 12.5 miles long) and would enhance access by providing a future footbridge across the river at Boulder Creek. This would shorten the trail distance from the Landing to Weaver Point Campground and provide a minor to moderate long-term beneficial effect for some people.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to visitor and resident access and transportation, interpretation and education, visitor use opportunities, scenic resources, and safety would include the following:

- Allowing construction delays and one-lane closures to be no longer than 20 minutes per passage through the project (longer delays could be approved in advance).
- Avoiding evening, weekend, and holiday work by requiring approval in advance. Longer construction delays or total road closures would also be approved in advance (see below).
- Distributing press releases to local media, and providing information on the boat to inform visitors about road conditions in the lower Stehekin Valley during the project.

- Using a public information program to warn of construction-related road closures, delays, and road hazards.
- Keeping a McGregor Meadows and Lower Field route open during reroute construction (Alternatives 2, 3 and 5).
- Providing notice to equestrians (e.g., Stehekin Valley Ranch) regarding conditions that could make the road temporarily impassable for horse crossing.
- Managing vehicle traffic and contractor hauling of materials, supplies, and equipment within the construction zone to minimize disruptions in visitor traffic.
- Developing a safety plan prior to the initiation of construction to ensure the safety of visitors, workers, residents, and park staff.
- Minimizing dust during construction on public roadways (by minimizing soil disturbance, spraying water [no chemicals] over disturbed soil areas during dry periods, and revegetating disturbed soil areas as soon as practical following construction).

Based on discussions between the NPS and FHWA, it is likely that the following measures would be used to reduce impacts of construction activities on visitors and residents if the proposal in Alternatives 2, 3 and 5 was implemented. These measures would also be similar under Alternatives 1 and 4 for the road rehabilitation actions.

- Daily hauling and work hours would be restricted in some areas.
- The road would be open at all times except when large culvert installation is occurring (currently projected to be at Wilson Creek, Thimbleberry Creek and the Milepost 8.5 creek, as well as during paving or Milepost 8.0 work.
- The road would be open for all shuttle bus service, as well as the Rainbow Falls tour.
- Emergency vehicles, hikers and bicyclists would be allowed safe passage through the work areas.
- Night work could be approved by the superintendent.

## Cumulative Impacts

Over time, visitors and residents have experienced moderate to major short-term and cumulative adverse impacts on access and transportation from the closure of the upper portion of the Stehekin Valley Road (above Car Wash Falls) and from periodic closure of the Stehekin Valley Road during flooding. Closure of the road after the 2003 flood initially resulted in a decrease in the number of visitors to areas above High Bridge, however, over time the number of visitors has risen and is now essentially the same as it was in the past, based on recent visitor use statistics. Other impacts have occurred from periodic closure of the road in the lower valley below High Bridge during and after floods. Alternative 1 and, to a lesser degree, Alternative 4 would continue to contribute minor adverse impacts to access because flooding damage could result in more frequent road closures, primarily during fall floods in McGregor Meadows than in other alternatives. Although the road through portions of McGregor Meadows would be raised in Alternatives 1 and 4, large floods could erode road fill or wash out other sections of roadway, resulting in the need for repairs before access could occur. Alternative 4 would contribute fewer adverse impacts because erosion protection measures and slight realignments would help to minimize the areas of future road washouts. Access along Company Creek Road would not change and would continue to be affected by periodic flooding. Extensive rock barbs, bioengineering, and three grade-control structures already in place on the upper Company Creek Road would continue to require maintenance.

Alternatives 2, 3 and 5 would contribute long-term minor to moderate beneficial impacts from dependable road access past McGregor Meadows, while Alternatives 2 and 5 would also contribute long-term dependable road access to above the Lower Field area. With erosion protection measures, Alternatives 2 - 5 would likely result in better access than Alternative 1 from bank stabilization. Alternative 5 would also result in additional cumulative beneficial effects on visitor access from construction of a Reroute Access Connector that would be available should access into the lower part of McGregor Meadows become unavailable. Drainage improvements at Milepost 9.2 should eliminate a problem caused by a debris flow in 2009. Slope stabilization at Milepost 8.0 under all alternatives would improve safety and access from reducing rock fall hazards.

### Conclusion

Alternatives 1 - 4 would have short-term negligible to moderate adverse and negligible to moderate beneficial impacts. Additional moderate adverse effects would occur in Alternatives 1 and 4 related to transportation of fill and flooding of access routes. Alternatives 2 - 4 would add long-term minor to moderate beneficial effects from actions at Milepost 8.0 and from stabilization of the road, whether in place or with a reroute. Additional minor adverse impacts would occur from erosion protection measures.

## 16. Visitor Experience: Interpretation and Education Impacts

### Interpretation and Education Methodology

Methodology would be the same as “Visitor Experience.”

**Type of Impact:** Same as “Visitor Experience.”

**Intensity of Impact:**

- **Negligible:** Impacts would be imperceptible or not detectable.
- **Minor:** Impacts would be slightly detectable or localized within a relatively small area.
- **Moderate:** Impacts would be readily apparent.
- **Major:** Impacts would be substantial, highly noticeable, and/or result in changing the nature and extent of programming.

## Interpretation and Education Impacts

### *Impacts from Alternative 1*

There would be ongoing minor to moderate beneficial impacts from existing interpretive and educational programs. As called for by the GMP, the Lower Valley Trail would provide several new interpretive opportunities. One would include opportunities for better interpretation of the Stehekin Wagon Road and its extant historic features in the lower valley and the other would include the old Skinny Wilson homestead near Wilson Creek, which is potentially eligible for the National Register of Historic Places. It would also provide opportunities to interpret numerous natural features in the lower valley. A relocated Bullion Campground would provide some limited additional opportunities to learn about resources from information signs in the camp. Effects on interpretation and education as a result of the implementation of Alternative 1 would be negligible to minor and beneficial.

### *Impacts from Actions Common to Alternatives 2 - 5*

Alternatives 2 - 5 would result in a variety of minor to moderate long-term beneficial effects on interpretation and education. Visitors and residents could learn more about the changes in the Stehekin River wrought by the increased frequency and magnitude of flooding and how this likely may relate to a changing environment. As in Alternative 1, there would be increased opportunities to learn about the Stehekin Wagon Road and Skinny Wilson's homestead from construction of the Lower Valley Trail. New campsites at Rainbow Falls and Purple Point Horse Camp (in Alternatives 2 - 5), a relocated Bullion Campground (in Alternatives 1 - 5) and a new Company Creek Campground (in Alternatives 3 and 4) would provide some limited additional opportunities to learn about Lake Chelan NRA resources from information signs placed at these locations in association with the camps.

The enhancement of interpretive and educational programming for the general public, local residents, and the media would include an emphasis on the value of large woody debris in the river environment, the role of flooding in river ecosystems, and on the value of allowing floodwaters to occupy the floodplain / channel migration zone by minimizing human impacts to river processes. These programs would continue to include river hazard-related visitor and resident safety messages to ensure meaningful, satisfying, and safe visitor experiences.

## Measures to Avoid, Minimize, or Mitigate Impacts

Same as Access and Transportation Impacts.

## Cumulative Impacts

Over time, there have been changes in both the number of programs and the diversity of interpretive and educational programming and targeted specific programs for different audiences. Alternatives 1 - 5 would have minor beneficial effects on interpretation and education. New interpretive opportunities would also increase in Alternatives 2 - 5 because of more access opportunities to learn about the river environment. When impacts of these alternatives are added to those that have occurred over time throughout the area, cumulative impacts would be negligible to minor, beneficial and localized.

## Conclusion

Alternatives 1 would have minor to moderate beneficial effects, with slightly more beneficial effects in Alternatives 2 - 5.

# 17. Visitor Experience: Visitor Use Opportunities Impacts

## Visitor Use Opportunities Methodology

Methodology would be the same as "Visitor Experience."

**Type of Impact:** Same as "Visitor Experience."

**Intensity of Impact:**

- **Negligible:** Visitors would not be affected or changes in visitor use opportunities would be below or at the level of detection. Any effects would be short term. Visitors and residents would likely be unaware of the effects associated with the actions.
- **Minor:** Changes in visitor use opportunities would be detectable, although the changes would be slight and likely short term. Visitors and residents would be aware of the effects associated with the actions, but the effects would be slight.
- **Moderate:** Changes in visitor use opportunities would be readily apparent and likely long term. Visitors and residents would be aware of the effects associated with the actions and would likely be able to express an opinion about the changes.
- **Major:** Changes in visitor use opportunities would be readily apparent and would have substantial long-term consequences. Visitors and residents would be aware of the effects associated with the actions and would likely express a strong opinion about the changes.

## Visitor Use Opportunities Impacts

### *Impacts from Alternative 1*

Alternative 1 would primarily continue to offer the current range of visitor use opportunities, including hiking, bicycling, horseback riding, rafting, skiing, hunting, fishing, and wildlife viewing. Interpretive and education programs, interactions with Stehekin residents, staff, and other visitors, and participation in wilderness experiences (solitude and primitive recreation experiences) would also continue. These would continue to provide long-term minor to moderate beneficial impacts.

The implementation of proposed actions in this alternative, however, would result in additional moderate long-term beneficial effects, including hiking and horseback riding opportunities from the construction of the Lower Valley Trail. Other benefits would include a new loop trail experience on the Stehekin River Trail and a safer driving experience on the road, with improved access to pullouts and an improved driving and bicycling surface. New parking and a formal, safe winter turnaround area would also benefit visitors. Surfacing the roadway would eliminate dust and decrease dust irritation to motorists and recreational users, particularly bicyclists and pedestrians. Road surfacing would have long-term beneficial impacts by improving bicycling opportunities in the lower valley. Overall impacts would be beneficial from maintaining access, increasing driver safety, and surfacing the road. There would be more sustainable opportunities to camp at the relocated Bullion Campground.

During and immediately following construction, wildlife viewing opportunities would likely diminish in the project areas, a short-term negligible to minor adverse effect on visitor use opportunities. During this time, there would be fewer opportunities to encounter natural conditions in the construction areas. Over time, as construction activities subsided, these impacts would diminish and most wildlife would return to the areas and opportunities would return or even increase, because of the increase in edge habitat in some areas.

### *Impacts from Actions in Alternatives 2 - 5*

Compared to Alternative 1, Alternatives 2 - 5 would offer the same kinds of visitor use opportunities; however, these would be expanded, a moderate mostly beneficial long-term impact. There would be more opportunities for visitors to learn about the Stehekin River through expanded interpretive programs and new interpretive signs at camps and along trails. There would be more camping opportunities from the establishment of campgrounds at Purple Point Horse Camp and Rainbow Falls, as well as more sustainable opportunities to camp at the relocated Bullion Camp. Although not all visitors would take advantage of all the expanded opportunities, effects would be mostly beneficial, but would also result in some negligible to minor adverse impacts on the experience of those visitors and residents who would prefer fewer formal camps, recreation facilities, and trails in the valley. It is likely that backpackers and groups visiting Stehekin, in particular, would benefit from expanded camping opportunities. There would be minor beneficial effects on fishing from creation of pool habitat and restoring riparian vegetation by constructing logjams and rock barbs along the Stehekin River.

Alternatives 3 and 4 would also include another campground at Company Creek, offering expanded camping opportunities off the main road. In addition, there would be a river access point on public land near the mouth of the river in Alternatives 2, 4 and 5. To the recreating public, this facility would represent a long-term minor to moderate beneficial impact by providing more convenient access at the end of a journey down the river or at the beginning of a journey to the head of the lake. Moving the entrance to the access road off private land would create a long-term minor to moderate beneficial impact for nearby landowners and the public. (The current road passes within ten feet of a cabin.)

Impacts associated with the Lower Valley Trail would be similar to those in Alternative 1; however, in Alternatives 2, 3 and 5, the trail would take advantage of more existing road and trail segments and would require fewer constructed miles than in either Alternative 1 or Alternative 4. In both cases, however, the trail would be approximately the same length. In Alternative 5, bicyclists could take advantage of the McGregor Meadows Access Road and the sections of Lower Valley Trail that would follow it to avoid the hilly sections of the reroute. Although this access would be provided, if there was a major washout, no extensive work would be undertaken to restore it. The road reroutes in Alternatives 2, 3 and 5 would add to the diversity of the driving experience along the Stehekin Valley Road in a way that would be preferred by some visitors and residents and disliked by others. Compared to Alternatives 1 and 4, the driving experience would be well away from the Stehekin River for 1.8 or 1.6 miles, depending on which reroute was implemented. Both would result in about 40 percent of this part of the road (within the project area) moving into a forested area, rather than a combination of open and forested landscape.

Although visitor use opportunities to see some wildlife species could diminish, opportunities to see other species would increase and except in a few areas, existing development would generally be less visible from the road. As noted below in the "Visitor Experience: Scenic Resources" section, there would be changes in the visual character of the road that would affect the visitor experience of scenic views and vistas along this same section of the road (Alternatives 2, 3 and 5). Whether this would be a beneficial or adverse impact would depend on the viewer. Rafters and anglers might prefer the removal of the road from next to the river, and although access would be via a flat, 0.5-mile-long trail to the east bank, the west bank is accessible from Company Creek Road. Alternatives 2 and 5 would also contribute some enhanced wildlife viewing opportunities in the Lower Field area, since there would be less human disturbance along the river, access would continue via the Lower Valley Trail, and wildlife sightings could increase. The reroutes would also provide long-term sustainable access to recreational opportunities in the upper valley.

All alternatives would result in the same kinds of short-term construction-related impacts to visitor use described above under Access and Transportation Impacts and in this section under Alternative 1, as well as those related to wildlife viewing described in Alternative 1. There would be fewer overall impacts from traffic delays related to the construction of the reroutes (Alternatives 2, 3 and 5) because the road through McGregor Meadows would remain open. There could be some delays on this route related to materials movement and deliveries until the reroute was complete (these alternatives would retain a 0.8 mile portion of the old road as the McGregor Meadows Access Road). Most of the adverse impacts to visitor use would occur between Company Creek Pit to McGregor Meadows due to construction and would result in minor adverse impacts on visitor use by causing increased levels of noise and dust, degraded views, and delays in accessing the upper or lower Stehekin Valley via the road. Increased noise and changes in visual quality could have short-term negligible adverse impacts on visitors in the wilderness area. The Reroute Access Connector in Alternative 5 would benefit visitors, however, it would be of most benefit to McGregor Meadows residents and others who needed to access this area if a major washout occurred and the lower section of the McGregor Meadows Access Road became unusable.

Since much of the current visitor use would occur well away from the proposed reroute and maintenance and housing replacement and relocation project areas, it would not be added to that of the reroute disturbance. Most other actions, however, would occur in the vicinity of visitor and residential use, and some residences are near the reroute alignment and the construction site for the new river access point in Alternatives 2, 4 and 5. Those residents and visitors near the road and the reroute construction areas would therefore experience short-term moderate adverse impacts from noise and activity related to road construction. The same would be true of residents and visitors along lower Company Creek Road and near the Stehekin airstrip, where a moderate amount of activity related to relocating the existing and constructing the new maintenance facility and housing (under Alternatives 1-4) would occur. Where housing was constructed elsewhere in the lower valley in Alternative 5, there would be short-term minor to moderate impacts from noise and activity where other residential areas were nearby. Trucks crossing Harlequin Bridge would result in short-term disruptions at Harlequin Camp and might be heard on the Stehekin River Trail. Temporary inconveniences related to construction would also occur to visitors and residents not being able to take advantage of some opportunities due to road construction delays.

Rerouting the road around McGregor Meadows in Alternatives 2 and 5 would result in closure of the shooting range because the direction of fire would be toward the road. In this case, the shooting range would be closed and no new site would be built. This would initially result in a long-term adverse impact to those who use the shooting range, however, future practice could also continue to occur on private land. This minor adverse effect would be coupled with a beneficial effect on those visitors who were adversely impacted by noise from it.

Alternatives 1, 3 and 4 would retain the shooting range in its current location, contributing to a long-term beneficial impact on visitor use opportunities.

## Measures to Avoid, Minimize, or Mitigate Impacts

Same as Access and Transportation.

## Cumulative Impacts

Resident and visitor use opportunities have increased gradually over time within Lake Chelan from the development of visitor facilities. Effects from the Forest Fuel Reduction Program have also likely contributed to increased wildlife viewing opportunities from the opening of thickly forested areas surrounding the road and from the creation of edge habitat from fuel-reduction activities, including from the ability to see into adjacent forested areas. Most erosion protection projects implemented over the last 15 years have not resulted in increases or decreases in resident and visitor use opportunities. Some projects, however, have altered the visitor experience on the road (such as the extensive Coon Run reroute). Although visitor use activities would remain largely unchanged under Alternative 1, this alternative would have long-term minor to moderate beneficial impacts on visitor use opportunities from the construction of the Lower Valley Trail and its linkage to the Stehekin River Trail and from improved driving conditions on a surfaced road. Negligible to minor short-term adverse effects would be contributed from construction activities, which would diminish wildlife presence in construction areas. When the effects of these activities are added to Alternatives 2 - 5, these alternatives would have the same effects as Alternative 1 plus would contribute an increasing series of minor to moderate long-term beneficial effects from establishing additional or improved camps and in Alternatives 2, 4 and 5, a formal river access point. Views and vistas would change on the Stehekin Valley Road in Alternatives 2, 3 and 5, with more of the road traversing a drier forested area, a minor long-term adverse or beneficial effect, depending on the viewer. Alternatives 1, 3, and 4 would retain a shooting range, while Alternatives 2 and 5 would remove it, a long-term beneficial or adverse effect, depending on the perspective of the visitor or resident.

## Conclusion

There would be few new opportunities in Alternative 1; however there would be improvements in existing opportunities. Compared to the negligible to moderate beneficial effects in Alternative 1, Alternatives 2 - 5 would have both more opportunities and more improvements (minor beneficial effects) than Alternative 1.

# 18. Visitor Experience: Safety Impacts

## Safety Methodology

Visitor and employee safety impacts were assessed qualitatively based on past studies which identified specific problems in the project area.

**Type of Impact:** See "Visitor Experience."

**Intensity of Impact:**

- **Negligible:** Visitors would not be affected or changes in visitor safety would be below or at the level of detection.
- **Minor:** Changes in visitor safety would be detectable, although the changes would be slight and likely short term.
- **Moderate:** Changes in visitor safety would be readily apparent and likely long term.
- **Major:** Changes in visitor safety would be readily apparent and would have substantial long-term consequences.

## Safety Impacts

### *Impacts from Actions Common to Alternatives 1 - 5*

The following specific actions called for by these alternatives would have negligible to moderate improvements (beneficial effects) on visitor, resident, and/or employee safety. These would include actions that involve the following:

#### Negligible Beneficial Impacts

- There would be ongoing grading of unsurfaced sections of road or access road (Alternatives 1 - 5).

#### Minor Beneficial Impacts

- Surfacing the road would reduce the potential for pothole formation and defensive driving methods required when they form (Alternatives 1 - 5).
- Surfacing the road would likely reduce visitor, staff, and resident bicycle accidents caused by riding on a gravel surface.
- Constructing a designated winter turnaround area with parking would improve operations and visitor experience (Alternatives 1 - 5).

#### Moderate Beneficial Impacts

- Improving sight distance along portions of the road, either by slight realignments or by adding pullouts (Alternatives 1 - 5), would improve driving conditions.

- Relocating the maintenance area from the Stehekin River floodplain / channel migration zone would reduce the amount of employee time spent in this area and residents' needs to go there for solid waste disposal as well as allowing access to emergency equipment when needed during flooding (Alternatives 1 - 5).
- Surfacing of the road would eliminate dust and improve air quality for residents, visitors (particularly bicyclists), and NPS employees (Alternatives 1 - 5).
- There would be reduced employee exposure to cramped conditions and hazardous materials, including asbestos, lead-based paint, and rodent infestations from constructing new, buildings designed for the maintenance area (Alternatives 1 - 5).
- There would be increased ability to pass safely from more pullouts both on the main road (Alternatives 1 - 5) and from adding pullouts to the reroutes (Alternatives 2, 3 and 5).
- Using barbs or logjams would protect vulnerable sections of the Stehekin Valley Road along steep riverbanks (Alternatives 2 - 5).
- Rock fall hazard would be reduced at Milepost 8.0 (Alternatives 2 - 5).
- Rerouting portions of the road away from the Stehekin River (Alternatives 2, 3 and 5) would increase the reliability of fire protection and emergency access.
- Changing LPP priorities regarding land acquisition and exchange (Alternatives 2 - 5) would allow residents in flood-affected areas to relocate to other parts of the lower Stehekin Valley, if desired.
- Constructing a Reroute Access Connector would improve access to McGregor Meadows in the event of a major washout of the McGregor Meadows Access Road (Alternative 5).

### Adverse Impacts

Long-term negligible to moderate adverse effects associated with all alternatives would remain from retaining sections of the Stehekin Valley Road in the floodplain / channel migration zone near the head of Lake Chelan and from the road's proximity to rock fall hazards along the lake shore, at Harlequin Bridge, and at Frog Island. In Alternatives 1 and 4, an additional 1.8 miles of road would remain vulnerable to floods in McGregor Meadows. In Alternatives 2, 3 and 5, there would be long-term negligible to moderate adverse effects from relocating the road where it would cross several debris cones formed by small, steep, tributary streams. Debris cones are formed, in part, by snow avalanches, debris flows, and flood deposits. None of these debris cones along the reroute area has had a recent debris flow; however, a snow avalanche occurred in 2008. Although there are some trade-offs in moving this road closer to the hillside, the road has been professionally designed and engineered to meet or exceed modern road standards and to minimize these hazards. The proposed route, however, does not cross an active snow avalanche chute (the 2008 avalanche did not reach it). Although the proposed reroute as designed is expected to be steeper in some locations, surfacing with a chipseal is expected to minimize the potential for an icy roadway. Based on experience and studies, it is more likely that the road would washout in its current location than that it would be impacted by an avalanche or debris flow in its new location.

All alternatives would continue to maintain access for emergency services such as emergency medical services, search and rescue, and fire suppression. This includes the McGregor Meadows access road in Alternatives 2 and 5, although this section could be temporarily closed by floods and flood damage. These services would be more consistent in Alternatives 2, 3 and 5 because the Stehekin Valley Road would be rerouted and available for use during flooding. Comparatively more locations could continue to wash out in Alternative 1 and, to a lesser extent, Alternative 4. Regardless, maintaining access would continue to be a high priority. Parts of Company Creek Road would continue to be closed by periodic flooding.

### Measures to Avoid, Minimize, or Mitigate Impacts

Same as Access and Transportation.

### Cumulative Impacts

Alternatives 1 - 5 would contribute a variety of negligible to minor beneficial impacts on visitor, resident, and employee safety. Road improvements under all alternatives would contribute the greatest number of these effects, while construction of the new maintenance area would result in improved operations efficiency and safety from the improved condition of facilities and working conditions. While Alternatives 1 and 4 provide minor safety improvements, Alternatives 2, 3 and 5 would result in long-term moderate beneficial impacts from improving safety conditions related to rerouting the road; as a result, Alternatives 2 and 5 would have slightly greater benefits.

### Conclusion

Alternatives 1 and 4 would contribute negligible to minor beneficial impacts on safety, while Alternatives 2, 3 and 5 would have moderate beneficial impacts because of the reroute and changes in LPP priorities. There would also continue to be negligible to moderate adverse effects from retaining sections of the road in the floodplain / channel migration zone where it cannot be moved (Alternatives 2, 3 and 5) or to retain the existing road alignment (Alternatives 1 and 4).

## 19. Visitor Experience: Scenic Resources Impacts

### Scenic Resources Methodology

Scenic resources impacts were assessed qualitatively based on how the proposed actions would change the appearance of scenery.

**Type of Impact:** Adverse impacts were considered those that would focus viewing on human-constructed modifications, rather than natural scenery; beneficial impacts would enhance a natural scenic view.

**Intensity of Impact:**

- **Negligible:** Impacts would be imperceptible or not detectable.
- **Minor:** Impacts would be slightly detectable or localized within a portion of the project area.
- **Moderate:** Impacts would be readily apparent.
- **Major:** Impacts would be substantial, highly noticeable changes to the character of the landscape.

## Scenic Resources Impacts

### *Impacts from Actions Common to Alternatives 1 and 4*

The scenic driving experience on the Stehekin Valley Road would not undergo major changes as a result of the implementation of Alternative 1. The road would continue to be a narrow, curvy, forested roadway, with close views of both the forest and the Stehekin River. During construction there would be negligible short-term effects on views along the road due to the presence of construction equipment in the project area, particularly staging areas, such as the Lower Field. Afterward, because construction would include removal of vegetation along the roadside related to ditch construction / reconstruction and pullout construction, there would be long-term adverse and beneficial effects. Initially, visitors would perceive that a change had occurred and would perhaps notice previously obscured views opened by the removal of some trees. Later, as plants began to fill in the open spaces, the road edges would revert to an array of vegetation similar to that now present.

The Stehekin Valley Road has been in place for decades, although minor reroutes have been common throughout the past 40 years at a number of sites. Although the road itself interrupts scenic values, it also provides access and a vantage point. By the same token, NPS and private development in the valley both facilitate and impede the visitor experience of scenic resources. Actions proposed in Alternatives 1 and 4 would not relocate or expand the main alignment of the Stehekin Valley Road, but would continue to maintain a park-like setting for the road. In addition, where maintenance facilities are currently impeding the floodplain / channel migration zone of the Stehekin River near Harlequin Bridge, these would be removed and the area restored, allowing more natural river processes to occur, a minor to moderate long-term beneficial impact on scenic resources.

Alternatives 1 and 4 would also have long-term negligible to moderate beneficial effects from reducing noise and dust along the Stehekin Valley Road by surfacing the road. The extensive amount of roadside vegetation covered with dust during the peak visitor use / summer dry season would be eliminated. Where new construction would result in loss of vegetation, including from constructing pullouts and the winter turnaround, as well as in removal of the eyebrow area in McGregor Meadows in Alternatives 1 - 5, there would be variable short- to long-term minor on moderate adverse impacts to visual quality from the loss of vegetation and from disturbance. Over time these impacts would diminish as revegetation and natural plant establishment occurred on the stabilized slopes.

Bioengineering associated with barb placement would eventually restore the riparian edge between the road and the Stehekin River in some places, possibly obscuring views. This effect would be greatest in Alternative 4, where 16 - 17 new barbs are proposed, and least in Alternative 1, where no new barbs are currently proposed. Because expansive views of the river are available from numerous locations along the road (downvalley from the Stehekin School, Frog Island, Harlequin Bridge, Company Creek, Milepost 8.0, and above Coon Creek), these adverse impacts on scenic resources would be negligible.

Construction of the Lower Valley Trail would open up nonroaded views of the Stehekin River and the head of Lake Chelan from numerous observation points, a long-term beneficial effect on scenic resources.

Under Alternative 1, the ongoing impacts from land acquisition and exchange in the lower Stehekin Valley by both private residents and the NPS would continue to result in periodic modifications of the scenic qualities within the project area. New homes and outbuildings would be developed where none were present before, with some houses clustered in areas outside the channel migration zone. Others would be removed as lands with undesirable development were acquired. Covenants to protect scenic qualities and scenic easements established through the 1995 LPP would continue to limit impacts to scenic resources.

### *Impacts from Actions Common to Alternatives 2 and 3 and Additional Impacts from Alternative 5*

Although many of the same beneficial and adverse impacts to scenic qualities from Alternative 1 would occur in Alternatives 2 - 5, there would be a series of additional beneficial and adverse impacts. These would include moderate adverse and beneficial effects from more bioengineering associated with barb placement (greatest in Alternatives 3 and 4) and additional long-term moderate beneficial and negligible short-term adverse effects from riparian restoration.

Reroute construction would result in moderate short- to long-term adverse effects (Alternatives 2, 3 and 5) due to the major change from a forested plant community to a highly disturbed area with road cuts and fills, ranging from disturbing areas just larger than the road width (16 feet) to between 40 and 100 feet beyond the road, where extensive cuts and fills are required. There would be changes in elevation (no greater than six percent) as the road ascended and then descended back to the valley floor. In Alternative 3, the steep descent into the Lower Field would be on top of an estimated eight to ten feet of fill. This fill section of roadway would not appear natural and would not blend into the open landscape of the Lower Field. Rather, it would be visible from approaches from the west on the Stehekin Valley Road and from the Lower Field. Alternative 3 would therefore have moderate long-term adverse effects on scenic resources. Overall, the road reroute area (approximately 40 percent of the road within the project area) in Alternatives 2, 3 and 5 would not have views of the Stehekin River, but would traverse a forested landscape. This would be offset by improvements in views toward McGregor Meadows associated with road removal. Where the road was moved farther away from the river, views toward the river would contain a more natural appearance, with riparian vegetation providing screening and a vegetated, rather than bare, corridor alongside the river or a series of cutoff roads as it was gradually relocated. In addition, as in Alternatives 1 and 4, construction of the Lower Valley Trail would open up numerous nonroaded views of the Stehekin River, wildlife, and surrounding landscapes, a long-term minor beneficial effect on scenic resources.

Compared to Alternative 1, there would be similar impacts from land acquisition and exchange because many of the key provisions that protect scenic qualities in the current LPP process would be retained in the modified priorities that would be implemented in Alternatives 2 - 5. It is likely, however, that potentially fewer lands in Alternative 4 would be acquired within the channel migration zone because the current development pattern would continue. In Alternatives 2, 3 and 5, development of potential exchange lands would result in clustering of some development in the Company and Boulder creek areas, a long-term minor to moderate adverse impact on scenic resources for the road. Emphasis on removal of cabins in the channel migration zone would improve scenic views along the river, a moderate long-term beneficial effect.

## Measures to Avoid, Minimize, or Mitigate Impacts

Same as Access and Transportation.

## Cumulative Impacts

The effects of past, present, and future actions have resulted in long-term beneficial and adverse effects on views and vistas from the Stehekin Valley Road. Past reroutes of the Stehekin Valley Road at Coon Run and 7.5 Mile have generally led to fewer river views from the road. Existing covenants and conditions for development of exchanged and adjacent lands resulted from the implementation of the 1995 LPP. When combined with these conditions, Alternative 1 would continue to contribute long-term negligible to moderate beneficial effects. Short-term adverse effects would continue to occur periodically from construction activities, response to flood damage of road, and from prescribed burns. Alternatives 2, 3 and 5 would contribute the same adverse and beneficial effects as Alternative 1, plus long-term adverse and beneficial effects from relocating a portion of the road from a riparian area near the river to a drier forested area away from the river. While there would be fewer opportunities for views and vistas of the Stehekin River from the rerouted section of the road, there would be new opportunities to observe upland forest species, and to view the river from a trail instead of the road. Long-term beneficial effects noted in Alternative 1 associated with the LPP would continue, but would vary slightly since the emphasis in Alternatives 2, 3 and 5 would be on acquiring lands within the channel migration zone. Scenic resources qualities along the road, though they would remain important, would be of lower priority in Alternatives 2 - 4. Alternative 5, however, would continue to emphasize the protection of scenic resources, along the lake. Similarly, Alternatives 1 and 4 would contribute additional long-term negligible to minor adverse effects from the effort to maintain the Stehekin Valley Road, as well as the Company Creek Road, in essentially their existing alignments, contributing both minor adverse and minor beneficial effects on scenic resources from maintaining views while altering natural topography and vegetation.

## Conclusion

Alternatives 1 and 4 would continue to have long-term negligible to moderate and short-term negligible to minor adverse effects on scenic resources, and long-term beneficial impacts from reducing dust, improving visibility, and removing NPS facilities from the floodplain, as well as from continuing to allow for the most views toward the Stehekin River from the road. Alternatives 2, 3 and 5 would contribute to the diversity of the Stehekin Valley Road driving experience, a long-term minor to moderate beneficial or adverse effect, depending on the viewer.

# 20. Wild and Scenic Rivers Impacts

## Wild and Scenic Rivers Methodology

The Stehekin River has been determined eligible as a Wild and Scenic River. The portion within the project area has been determined eligible for its recreational characteristics; above High Bridge it is eligible for its scenic characteristics; and farther upvalley, near Cottonwood Camp, it is eligible for its wild characteristics (see Chapter III: *Affected Environment*, “Wild and Scenic Rivers” for definitions of these).

The Wild and Scenic Rivers analysis assesses potential effects of the proposed alternatives on the characteristics of the Stehekin River that contribute to the river's eligibility for listing as a component of the National Wild and Scenic Rivers System. Those characteristics include the free-flowing nature of the river and the outstanding remarkable values provided by the river and its immediately surrounding lands. The outstandingly remarkable values for the Stehekin River are prehistoric and historic resources, geology, scenic resources, wildlife/fish, and recreation.

**Context of Impact:** Wild and Scenic Rivers impacts were considered within the project area and associated with the Stehekin River as a whole.

**Type of Impact:** Beneficial impacts would improve wild and scenic river characteristics compared to existing conditions, while adverse impacts would reduce eligibility characteristics.

**Intensity of Impact:**

- **Negligible:** The effect on the values for which the river segment was determined eligible for listing as a Wild and Scenic River would be at the lowest levels of detection, barely measurable, with no perceptible consequences, either adverse or beneficial.
- **Minor:** A perceptible effect would occur to one or more of the values for which the river segment was determined eligible for listing as a Wild and Scenic River, but the effect would be localized to relatively small areas. Little, if any, loss of value or integrity would occur.
- **Moderate:** A readily apparent effect would occur to the values for which the river segment was determined eligible for listing as a Wild and Scenic River. The effect would diminish some of the values, but not enough to threaten the river's listing in the National Wild and Scenic Rivers System.
- **Major:** A readily apparent effect would occur to the values for which the river segment was determined eligible for listing as a wild and scenic river. The effect would be severe enough to threaten segment 1's eligibility for inclusion in the National Wild and Scenic Rivers System.

## Wild and Scenic Rivers Impacts

### *Impacts from Actions Common to Alternatives 1 - 4*

As noted in Chapter III: *Affected Environment*, the proposed project area under all alternatives is within Segment 1 of the Stehekin River, an area proposed for its recreational values, primarily because of existing disturbance to the riverbank, including the presence of roads, houses, businesses, power lines, and other human development. Segment 1 begins at the mouth of the river on Lake Chelan and extends up to High Bridge. As a result, the following discussion is limited to potential effects that would occur related to the eligibility of Segment 1 for Wild and Scenic River status. At the time Segment 1 was determined eligible for this status, it contained an estimated 80 erosion protection structures, including cabled logs, rip-rap, and rock barbs or a combination of these structures at approximately 35 sites, as well as one major bridge and other minor bridges over tributaries (NPS LACH 2005a). According to the analysis, these channel modifications or restriction were considered "generally unobtrusive and of short length."

### Free-flowing

In Alternative 1, additional riverbank modifications would occur at Milepost 5.3 (Wilson Creek). Alternatives 2 and 5 would include additional actions at Milepost 5.3, plus there would be modifications to areas near the river mouth, at Frog Island, and at Boulder Creek. Alternatives 3 and 4 would include these same areas but would add additional modifications at the Lower Field and Weaver Point, while Alternative 4 would also include modifications (barbs) at Milepost 7.0 and Milepost 9.2. At Wilson Creek and Frog Island, the barbs and logjams would be at the edge of the channel migration zone, where their impact on the free-flowing nature of the river would be relatively minor. As noted above, these modifications would be the same as (barbs) or similar to (logjams) those mentioned in the Wild and Scenic River eligibility report. Both the barbs and the logjams would locally redirect streamflow, change bank and sediment erosion and channel avulsion processes, and increase the amount of pool vs. riffle habitat. Alternatives 2 - 5 would also remove some rip-rap at the Stehekin River mouth, while adding other beneficial features, such as riparian restoration and the bioengineering component associated with rock barbs and logjams. In Alternatives 2, 3 and 5, relocating the road away from the eroding riverbank would have a minor to moderate beneficial effect by eliminating the need for additional erosion protection structures and allowing natural river processes, such as the river's free-flowing characteristics, to be enhanced.

Compared to Alternative 1, Alternatives 2, 3 and 5 would have negligible to moderate beneficial effects from relocating part of the road away from the river and from restoration, as well as minor adverse effects from rock barbs. Rock barbs would have minimal effects on river recreation. Both beneficial effects and adverse effects would be fewer in Alternative 3 from less relocation of the road and from less restoration and more logjams. Alternative 4 would have even fewer beneficial effects (no reroute), and there would be additional minor to moderate adverse effects from more barbs than in other alternatives.

### Prehistoric and Historic Resources

As noted above in cultural resources, there would be no effect on known prehistoric or historic resources from the implementation of Alternative 1. Alternatives 2 - 5 would have no effect on prehistoric resources. Alternatives 2, 3 and 5 would have no adverse effect on historic resources. A portion of the Stehekin Wagon Road, which has been determined to be ineligible for the National Register, could be affected by the proposed 1. 9-mile reroute through McGregor Meadows and the Lower Field. Alternatives 2 - 5 would have beneficial effects on the Buckner Homestead Historic District from the restoration of the riparian area alongside the Stehekin River. Since this restoration would also have no adverse effect on historic resources and because vegetation is not considered a contributing outstandingly remarkable value of the Stehekin River, there would be a negligible beneficial effect combined with minor adverse effects on the continued contribution of historic resources to the eligibility of the Stehekin River as a Wild and Scenic River in Segment 1 in Alternatives 2, 3 and 5 and a negligible beneficial effect in Alternatives 1 and 4.

### Geology

Because there would be no effects from the proposed project on glaciers, ice fields, cirques, spires, hanging valleys, or bedrock box canyons, there would be no effect on the glacial features which contributed to the identification of geology as a contributing outstandingly remarkable value on Segment 1 of the Stehekin River. Instead, effects would be limited to local surficial landforms that would be excavated or otherwise modified for shoreline stabilization measures and road-related infrastructure improvements at Milepost 5.3, Wilson Creek (Alternatives 1 - 5), and Milepost 8.0 (Alternatives 2 - 5), as well as for the proposed maintenance and housing areas (Alternatives 1 - 5) and the reroutes (Alternatives 2, 3 and 5). The spatial scale of these adverse impacts would be negligible compared to the overall scale of the geologic values that would remain unaffected by the proposed actions in the alternatives. Further, landforms at those sites are relatively young.

### Scenic Resources

The scenic resources called out in the eligibility report for the Stehekin River include the landscape dominated by dramatic, glacially sculpted landforms, diverse vegetation, and exceptionally clear, flowing water. As noted in the report, human impacts are few and unobtrusive and allow visitors to experience the grandeur of the wilderness and its landscapes.

As noted above, the glacially sculpted landforms characteristic of this outstandingly remarkable value would not be compromised by the proposed project under Alternatives 1 - 5. Although both water and vegetation would be affected by the proposed project under all alternatives, the changes to these characteristics would not have long-term adverse effects on landforms or the diversity of vegetation.

The proposed project actions would locally affect the quantity of vegetation in road reroute areas in Alternatives 2, 3 and 5. There would not be other than short-term localized effects on the clarity of flowing water. Beneficial vegetation effects would be realized from riparian restoration noted above at Weaver Point, the Stehekin River mouth, Buckner Homestead hayfield and pasture, Frog Island, and Lower Field in Alternatives 2 - 5. Beneficial impacts would also occur in Alternatives 1 - 5 from restoration of the former maintenance area, which is within 0.25 mile of the river. There would be negligible adverse and beneficial effects from installation of barbs and accompanying bioengineering in Alternatives 2 - 5, particularly at sites on the edge of the channel migration zone. Vegetation effects would be moderate and short to long term associated with the reroutes in Alternatives 2, 3 and 5, but effects over this area would not affect the eligibility of the Stehekin River as a Wild and Scenic River because they would be located more than 0.25 mile from the river, outside the potential area of eligibility noted in the report.

Overall, there would be a variety of short-term effects on scenic resources from the implementation of the alternatives. A variety of landscape elements would include long-term alteration, including from clearing vegetation, and moving the road farther from the river. Foreground and background views from the road would change under all alternatives (related to the winter turnaround and pullouts in Alternatives 1 - 5) and would be primarily associated with the road reroutes in Alternatives 2, 3 and 5. While these would have additional effects on scenic resources, they would not affect the scenic resources characteristics called out by the eligibility report because of their distance from the river.

As a result, the proposed project under Alternatives 1 - 5 would have negligible to minor short-term adverse effects, combined with similar beneficial effects, on scenic resources associated with the scenic resources outstandingly remarkable value noted in the Stehekin River eligibility report. The adverse effects would be primarily short-term adverse impacts to water quality and the beneficial effects would be associated with riparian restoration and bioengineering. Potential adverse effects would be present in all alternatives (Alternatives 1 - 5), with effects increasing from Alternative 1, 2/5, 3 to 4, while beneficial effects would be greatest in Alternative 2/5, followed by Alternatives 3, 4, and 1.

### Wildlife/Fish

Alternatives 1 - 5 would have primarily short-term adverse impacts associated with construction on some fish and wildlife. Wildlife would be more likely to avoid the construction areas during, and potentially for a short time after, construction. There would be several benefits to fish by creating pool habitat, which is more scarce than other habitat types (such as riffle habitat), and providing additional riparian vegetation along the riverbank (such as willow layering to provide shade and woody debris) (NPS LACH 2005a) in Alternatives 2 - 5. Once the road was surfaced there would be less sediment eroding from the road, and slope-stabilization measures (Alternatives 2 - 5) would also help to reduce the amount of eroded sediment entering the river. Thus, overall water quality and habitat for fish would be improved.

These impacts would not affect the diversity of game and nongame wildlife and fish and/or threatened and endangered species called out as an outstandingly remarkable value and identified in the Stehekin River Wild and Scenic River eligibility report. Despite short-term impacts and long-term loss of minor portions of upland forested habitat, the diversity of wildlife and fish species present in and near the Stehekin River would remain. Species would continue to depend on the Stehekin River for all or part of their lifecycle, and the river would remain an important habitat component and migration route despite short- and long-term adverse impacts identified here. There would be no effect on the diversity of wildlife and fish species related to the proposed project under Alternatives 1 - 5. As a result, this outstandingly remarkable value would remain a valuable component of the Stehekin River's eligibility in Segment 1.

### Recreation

Recreational values in Segment 1 would remain similar in Alternative 1, with some enhancement within 0.25 mile of the Stehekin River, including a crossing of the proposed Lower Valley Trail connecting to the Stehekin River Trail near Boulder Creek. This would have a negligible to moderate beneficial effect on recreation as an outstandingly remarkable value called out by the Stehekin Wild and Scenic River eligibility report. Construction of a foot-bridge could result in minor to moderate impacts to the river. In Alternatives 2 and 4, a moderate long-term benefit would occur from construction of the raft launch. There would also be negligible to minor adverse effects on recreation from the potential need for installation of some additional erosion protection structures at the bridge crossing. During most of the year, rock barbs would constitute a minor hazard to river rafters by creating an obstruction in the channel. The obstruction would be topped during high-flow periods in the spring and early summer, when floating the river is most popular. Later in the summer, however, part of the structure would protrude above the water surface, although the effects would likely have no greater impact to recreation than other obstacles along the river (Allen, pers. comm., 2005 in NPS LACH 2005a). Rock barbs would be unobtrusive because to be effective, they would be installed generally below the high water mark of the river. This makes them compatible with river runners and undetectable to most visitors. Consultation with river rafters would occur regarding the placement of logjams. Other features, such as grade-control structures, would be hidden (below grade), while logjams would appear natural. Bullion camp would be within the 0.25 mile affected area and would be considered a minor beneficial effect that would improve the recreation qualities associated with the Stehekin River.

Alternatives 2 - 5 call for additional enhancement of Stehekin River recreational features within the 0.25-mile affected area, including some additional camps adjacent to the river (Rainbow and Bullion camps in all three action alternatives [Alternatives 2 - 5] and Company Creek Camp in Alternatives 3 and 4). Along with the river access point in Alternatives 2 and 4, the camps would be considered minor to moderate beneficial effects that would improve the recreational qualities associated with the Stehekin River. There would be no adverse effect on the desire of visitors from outside the region to visit the Stehekin River, the key characteristic of the recreation outstandingly remarkable value called out in the eligibility report for the river. Therefore, improvements under Alternatives 1 - 5 would result in enhancement of this value, and there would be no adverse effects on it.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to Wild and Scenic Rivers would include mitigation measures listed in the "Water Resources," "Vegetation," "Wildlife," and "Visitor Experience: Scenic Resources" sections.

## Cumulative Impacts

Since the eligibility report was written, there have been about ten new sites with erosion protection features along the river in Segment 1. While these have resulted in slight modifications to the free-flowing nature of the river, the designation of this segment of the river under recreation allows for their continued persistence and other additions that remain unobtrusive. Because rock barbs and other features associated with protecting the riverbanks from erosion either appear natural or would be below the ordinary high water mark, they would continue to be unobtrusive. Although additional future measures would likely be added, primarily under Alternatives 1 and 4, where the road is essentially retained in place, and would be maintained under all Alternatives (1 - 5), these alternatives would continue to contribute negligible to minor long-term adverse cumulative impacts. These impacts, however, would not affect the eligibility of the river to be nominated as a Wild and Scenic River in Segment 1 for recreation and would have no effect on potential designation in segments 2 and 3 as scenic or wild, respectively.

Effects in Segment 1 would continue to be minimal because the same kinds of erosion protection measures as currently existing would be added (Alternatives 1 - 5) and because additional portions of the river would be released to natural conditions (because of reroutes in Alternatives 2, 3 and 5). As a result, Alternatives 1 and 4 along with past projects would contribute long-term moderate adverse effects. Alternatives 2, 3 and 5 would also contribute some moderate beneficial impacts, in addition to negligible beneficial effects in Alternatives 1 and 4. Removal of private cabins from within the channel migration zone would have a long-term moderate beneficial effect on Wild and Scenic River values. It is likely more cabins would be removed in Alternatives 2, 3 and 5 due to the LPP focus in the channel migration zone. Alternatives 2, 3 and 5 add new bank protection structures at four sites (Alternatives 2 and 3) and six sites (Alternative 3).

If the Stehekin River were designated as a National Wild and Scenic River, a 0.25-mile corridor on either side of the river would be designated to preserve its wild and scenic values. Because the river was found eligible with existing developments in place and because it also contained over 80 erosion protection and bank modifications (as noted in the report), there would be no effect on the status of the Stehekin River as a Wild and Scenic River from the additional modification of the river or the withdrawal of development from its floodplain as described in the action alternatives. All of the outstandingly remarkable values, including fish/wildlife, prehistoric resources, historic resources, geology, scenic resources, and recreation resources, of the Stehekin River would be maintained regardless of the implementation of Alternatives 1 - 5.

## Conclusion

There would be no adverse effect on the following outstandingly remarkable values in Alternative 1: prehistoric and historic resources, geology, scenic resources, wildlife, or fish. Minor beneficial effects would occur from the creation of the Lower Valley Trail and its connection to the Stehekin River Trail. Although there would be additional erosion protection measures at Wilson Creek in Alternative 1, these would continue to be "unobtrusive and of short length" and would not affect the ability of the Segment 1 portion of the Stehekin River to be designated as a Wild and Scenic River for recreation.

Alternatives 2 and 5 would have no effect on prehistoric resources, geology, scenic resources, wildlife, or fish outstandingly remarkable values associated with the Stehekin River. There would be negligible to minor beneficial effects on historic resources from riparian restoration along the Buckner Homestead hayfield and pasture adjacent to the river. Similarly, there would also be minor beneficial effects on recreation from the designation of some additional camps and a river access point, along with negligible to minor adverse effects from additional barbs or logjams near steep sections (at Frog Island, Wilson Creek, and the river mouth), as well as some impacts near Boulder Creek. As in Alternative 1, the effects in Alternatives 2 and 5 would not affect the ability of the Segment 1 portion of the Stehekin River to be designated as a Wild and Scenic River for recreation. The river would continue to be free flowing, with short, unobtrusive impediments to river flow, and would continue to possess more than one outstandingly remarkable value.

Alternatives 3 and 4 would have effects similar effects to Alternatives 2 and 5, except that there would be additional barbs and/or logjams constructed within the Stehekin River. Alternative 4 (and eventually Alternative 1) would add erosion management structures at eight sites within the potential 0.25-mile eligibility zone for the river. Alternative 4 would not have the same degree of beneficial effects due to maintenance of the road in the same location. In addition, there would be one more camp (Company Creek) to enhance recreational use in Alternatives 3 and 4. For the same reasons noted in Alternatives 2 and 5, the river would continue to be free flowing, with short, unobtrusive impediments to flow, and would continue to possess more than one outstandingly remarkable value. There would be no effect on the eligibility of the Stehekin River in Segment 1 to be designated a Wild and Scenic River for recreation.

# 21. Park Operations Impacts

## Park Operations Methodology

Impacts for each action alternative were evaluated by identifying changes to operations outlined in each of the action alternatives. These effects were compared to existing operations, staffing, and funding.

**Context of Impact:** Park operations impacts were considered within the project area and for the North Cascades NPS Complex.

Impacts on park operations would result from the need for additional staffing or changes in duties for current staff, changes in funding levels, changes in facilities, and from cost-saving measures associated with new facilities. Planning and implementing projects requires staff time, expertise, and assistance, which must be taken from daily duties such as visitor contacts, interpretation, resource protection, and safety.

**Type of Impact:** Adverse impacts would increase staffing, operating costs or fuel consumption. Beneficial impacts would decrease these. With beneficial impacts, the efficiency of park operations would also be improved and may lower the overall cost of operation. The discussions of impacts are for those operations that would be new, undergo major operational change, or show susceptibility to increases or decreases in operational activity. For example, old facilities would require additional staff time to operate or maintain, whereas replacement of facilities would likely use existing staffing levels. Impacts on park operations would result from the need for additional staffing or changes in duties for current staff, changes in funding levels, and from cost-saving measures associated with new facilities.

**Intensity of Impact:**

- **Negligible:** Park operations would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on park operations.
- **Minor:** The effects on park operations would be detectable but would be of a magnitude that would not have an appreciable effect on park operations.
- **Moderate:** The effects on park operations would be readily apparent and would result in a substantial change in park operations in a manner noticeable to staff and the public.
- **Major:** The effects on park operations would be readily apparent, would result in a substantial change in park operations in a manner noticeable to staff and the public, and would be markedly different from existing operations.

## Park Operations Impacts

### *Impacts from Actions Common to Alternatives 1 - 5*

#### Road Rehabilitation

Typical construction impacts would include temporary delays for staff and related activities such as tour buses moving through the construction area. These would produce short-term, minor adverse impacts on park operations. Some actions associated with road rehabilitation would be common to all alternatives, including pullout and winter turnaround construction, culvert installation and repair or replacement, and surfacing. These actions would result in short-term negligible to minor adverse impacts on park operations (staffing) from maintaining construction oversight, including contract monitoring. After construction, long-term negligible to minor beneficial impacts would occur from a decreased workload associated with maintaining new road facilities in good condition.

Rerouting the road to higher ground (Alternatives 2, 3 and 5) or raising the road height (Alternatives 1 and 4), stabilizing portions of the Stehekin River banks, directing the erosive force of the Stehekin River away from the road, and laying back slopes to prevent material from sloughing onto the road would reduce the potential for road closures, temporary delays, the need for maintenance activity, and other access problems for park staff, visitors and residents. The effectiveness of the road would also be improved by surfacing the road, increasing sight distance, and providing pullouts to facilitate traffic movement. Surfacing the road would also make snowplowing operations more efficient and reduce the potential for damaging the snowplow.

Once these improvements were completed it is likely that less staff time and resources would be required to maintain operations on the Stehekin Valley Road.

### Maintenance Facility Replacement and Relocation

Construction of the replacement maintenance facility would have a series of beneficial and adverse impacts on park operations. Overall impacts from construction of the new facilities would be major and beneficial. Individual impacts would vary from negligible to moderate. There would be short-term minor to moderate increases in staff responsibilities for construction planning and design oversight, as well as long-term negligible to minor changes in operations related to managing the new facilities. Construction of the new facility would initially result in fewer maintenance needs associated with new structures in good condition, a long-term moderate beneficial effect. Over time, however, age and deterioration would increase maintenance needs, but would not approach the current level because the new facilities, unlike the old, would be designed for their designated uses and location (including tolerance for weather conditions, such as snowload).

Long-term economic benefits would be realized from the new maintenance facility, which is expected to save the NPS approximately $6,000 per year in utility costs alone and more than $71,600 in annual maintenance costs. These cost savings would be realized from having the buildings and structures consolidated in one area and would result from savings attributed to snow removal and maintenance in addition to utility costs. Replacement and relocation would also avoid the potential for more severe damage to the facility from flooding.

Because the new facilities would be centrally located and would consist of a new, more functional arrangement of structures, there would be long-term negligible to minor beneficial effects from consolidated, efficient operations. Because the new buildings would be designed to be energy efficient, there would be long-term minor to moderate cost savings associated with improved efficiency and reduced energy consumption. Employees would have regular access

Photo 33 – Visitors to Lake Chelan NRA get information about the area at the Golden West Visitor Center.

to break / restroom facilities within appropriate structures and would have some diminished responsibilities in maintaining the new facilities, for example because roof pitches would be designed to shed snow load, these would not need to be shoveled.

The new maintenance area would have minimal duplication in heating mechanisms. Instead of stocking parts related to several different kinds of heating devices (wood, pellet, propane, and diesel devices, depending on the building), these would be of the same types and would use the same kinds of parts, resulting in operations cost savings.

There would be short-term increases in staffing or contract oversight to remove the former maintenance facility and to relocate, salvage, or deconstruct useable portions of it. Long-term beneficial effects would be realized from relocating it out of the floodplain. These beneficial effects would be most apparent during future flooding of the area, when the new maintenance area would remain functional rather than being located partially within a flooded area. Instead of equipment access and use being hampered by flooding, needed equipment would be readily available for use during emergencies, requiring less time to respond to staff, resident, and facility problems.

#### Housing Area

As with the maintenance area, construction of new housing would initially result in fewer maintenance needs; however, over time maintenance of these facilities would increase as age and deterioration occurred. There would be initial long-term beneficial effects from the use of new structures outside the floodplain or channel migration zone for housing coupled with short-term negligible to minor adverse effects over time. Similar benefits would be realized associated with the design and maintenance of the new housing, including cost savings associated with reduced energy use, etc. There would also be minor to moderate long-term beneficial effects from the expansion of housing for seasonal and concession staff. In Alternative 5, there would be both adverse and beneficial effects on park operations from locating housing in dispersed areas in the lower valley. Benefits would include more integration of housing within the community, while negligible to minor adverse effects would include travel time to service housing in different areas.

#### Other Actions (Alternatives 1-5)

There would be negligible to minor short-term adverse effects on park operations from the implementation of additional measures from the Road Improvement Project, including rehabilitation of the Stehekin Valley Road near Wilson Creek, installation or replacement of culverts, surfacing of the road, and other actions, such as ongoing maintenance of the Company Creek Road. Long-term beneficial effects would occur from repair of these areas, minimizing the need for repeated, more costly maintenance actions, such as fixing portions of the road after each major storm. Ongoing maintenance of the road would be similar to existing conditions, with a variety of actions performed, depending on the season (see Chapter III: *Affected Environment*).

### *Additional Impacts from Alternative 1*

Most actions within Alternative 1 would be a continuation of current management. In addition to those actions that would be common to all alternatives; however, Alternative 1 would include retention of / improvements to the Stehekin Valley Road in McGregor Meadows and in other places within the floodplain / channel migration zone of the Stehekin River; ongoing implementation of the 1995 LPP; and other actions that would affect park operations.

### Road Grade Raise / Rehabilitation

Initially, there would be oversight and consultation with FHWA to procure a contractor to execute road improvements, including the raising of the road and other improvements within McGregor Meadows, as well as for other actions associated with the rehabilitation of other portions of the roadway noted above. Later there would be park staff impacts from oversight related to implementation of the proposed road project. These would constitute short-term minor to moderate adverse impacts and long-term minor beneficial impacts.

Under this alternative, the NPS would continually need to make major repairs to the Stehekin Valley Road, particularly near McGregor Meadows. These actions would cause moderate adverse impacts on park operations, because staff time and park resources would be diverted to respond to the flood damage. Responding to flood damage would affect park operations at both a local and regional level. These circumstances would continue to diminish the ability of the NPS to conduct other operational activities.

Reaction to flooding on a case-by-case basis would cause a much greater impact to park operations when compared to the comprehensive and integrated strategies presented for each of the action Alternatives 2 - 5. There would be an ongoing need to make emergency road repairs following flooding to keep the road in use. These additional locations where erosion protection measures would be needed have not yet been identified, but would likely be similar to Alternative 4. Over time as more portions of the road were hardened or moved away from the Stehekin River, the need to harden banks would likely diminish. Until then, there would continue to be long-term minor to moderate adverse effects on park operations from repeated interruptions due to flood damage impacts and assessment of those impacts and then from constructing repairs.

### 1995 Land Protection Plan Implementation

Ongoing implementation of the 1995 LPP (NPS LACH 1995b) would continue to require park staff to write future EAs for land exchanges and to exercise oversight of the land protection program. The program would also continue to require regional office staff oversight to work with landowners to orchestrate actions in conjunction with the program and to determine the need for appraisals and covenants and to facilitate transfers under real estate law and policy, while protecting resources. These would be both short- and long-term negligible to moderate impacts, periodically taking up most of the work of some staff for up to a few months at a time.

### Research and Monitoring

Ongoing monitoring provides a framework for understanding the Stehekin River and has been important to understanding how often large floods occur (flow gauge monitoring), a long-term moderate beneficial effect. There would continue to be ongoing negligible to moderate impacts to park operations to conduct and fund monitoring programs.

## *Additional Impacts from Actions Common to Alternatives 2, 3 and 5*

### Road Reroute

Negligible to minor short-term adverse impacts, coupled with long-term moderate beneficial effects, on park operations would occur from rerouting a portion of the Stehekin Valley Road around McGregor Meadows and Lower Field in Alternatives 2 and 5 or from a reroute around

McGregor Meadows in Alternative 3. While the longer reroute in Alternatives 2 and 5 would have more beneficial effects from bypassing both portions most subject to future impacts from flooding, and erosion, the shorter reroute would also have beneficial effects because it would be coupled with additional erosion protection measures at the Lower Field. The short-term adverse impacts would be related to delays of park staff and additional responsibilities related to construction oversight and monitoring, while the beneficial effects would be from the realignment of the road that would reduce the long-term need to maintain and/or to reconstruct this portion(s) following flood impacts.

There would be minor to moderate adverse effects from the need to maintain a McGregor Meadows Access Road, as well as the reroute, under Alternatives 2, 3 and 5. Efforts to maintain this access road to a standard that permits resident and visitor access and emergency and utility system access would be required on a regular basis and would also require restoring access / repairing this section of the road following flooding. Because the road is proposed to be 0.8 mile long, rather than approximately two miles long, impacts associated with maintaining the road would be more limited than those that occur now after flooding and that would continue to occur in Alternatives 1 and 4 from maintaining the primary road all the way through these areas.

### Erosion Protection Measures

To the extent that park staff is involved in the construction of erosion protection measures, there would be effects on staffing and funding as well as effects from potential road delays related to these. Short-term effects would be minor to moderate, while long-term beneficial effects from the measures working to retain the road (therefore minimizing additional staff time related to repairs) would be minor to moderate.

### Land Protection Plan Modifications

While priorities would be different than in Alternative 1, the duties would remain similar. Initially, however, there would be an increase in impacts on park operations until park and regional staff became familiar with the revisions and their implementation became routine. Effects would remain intermittent and would be minor to moderate, and primarily dependent on the number of people seeking land exchanges.

### Research and Monitoring

Impacts from Alternative 1 would continue and additional negligible to moderate impacts on park staffing and funding would continue to implement additional monitoring programs called for by these alternatives.

### Other Actions

Numerous other actions called for by Alternatives 2, 3 and 5 would have short-term negligible to moderate impacts on park operations to deal with increased responsibilities for some staff related to project planning, implementation, and oversight. Among these would include construction of the Lower Valley Trail, implementation of erosion protection measures at Wilson Creek, and ongoing park operations related to maintaining the Stehekin Valley Road. Upon completion these actions would have long-term beneficial effects from establishing or returning the road to good condition, thus minimizing future needs for repairs. For many actions, repairs would become cyclic, rather than routine, after improvements were made.

### *Additional Impacts from Alternative 4*

#### Road Grade Raise / Rehabilitation

Impacts from Alternative 4 would be similar to Alternative 1, however the more extensive road grade raise would contribute additional adverse effects. Because there would be a similar array of erosion protection measures as in Alternative 3 (plus two additional sites), retention of / improvements to the Stehekin Valley Road would be more secure in Alternative 4 compared to Alternative 1. Decisions about where to locate erosion protection measures have been made in Alternative 4, compared to Alternative 1. Still, because flooding could result in additional damage and failure of the road, particularly in vulnerable sections of the Stehekin Valley Road where the road was not rerouted, impacts on park staffing and funding to ascertain and repair flood-related damage would continue to occur and would range from minor to moderate, depending on future flood damage.

#### Erosion Protection Measures

There would be more impacts from constructing 16 - 17 rock barbs. Overall impacts would be adverse and both short- and long-term, while beneficial effects would range from minor to moderate.

#### Land Protection Plan Modifications

As in Alternative 1 and Alternatives 2, 3 and 5, impacts would be intermittent and minor to moderate.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to park operations would include the following:

- Providing and maintaining emergency vehicle access through the project area during construction.
- Coordinating work between NPS and FHWA park liaison to minimize disruption to normal park activities.
- Monitoring construction activities to ensure adherence to mitigation measures.
- Monitoring construction activities to provide recommendations to minimize impacts on park resources.
- Conducting legal boundary surveys prior to scheduling work that may have the potential to affect private property. If necessary, easements would be negotiated.
- Designing new building construction to be silver or greater LEED certified.
- Using functional, energy-efficient appliances and heating and cooling systems in new buildings.
- Designing efficient circulation spaces for new maintenance and housing areas.

- Using contractors and term employees to facilitate short-term workload increases.
- Providing emergency vehicle access through the project area during construction. Coordinating work with park staff to reduce disruption to normal activities.
- Informing construction workers about the special sensitivity of park resources and values and regulations.
- Providing orientation about park resources for the contractor(s).
- Encouraging park resource specialists to be involved in inspections and monitoring and providing recommendations during the road rehabilitation and facility construction work.

## Cumulative Impacts

Over time, there have been a series of cumulative impacts on park operations from ongoing use of a cluster of old buildings in the floodplain for a maintenance facility, and from continued maintenance of the Stehekin Valley Road within the floodplain / channel migration zone of the Stehekin River. These impacts on park operations have ranged from poor response time to incidents during flooding from trying to reach vehicles in flooded areas to ongoing use of buildings that were not designed for their current functions. Alternatives 1 - 5 would not contribute to these cumulative impacts and would instead provide beneficial impacts because of proposed replacement and relocation of the current maintenance facility and implementation of erosion protection measures and/or a series of changes to the Stehekin Valley Road to help better maintain it.

A series of road reroutes and raising the road grade have been used to move the road farther away from the river and/or to protect the road from flooding. Future projects would have similar goals, which typically provide long-term beneficial effects on park operations. Alternative 1 would continue to contribute a minor to moderate degree of cumulative impacts to park operations because it would continue to respond to most flood-related damage on a case-by-case basis, improving only the retention of the road through McGregor Meadows (by raising the road). Alternatives 2 and 5 would contribute negligible to minor adverse cumulative impacts and long-term minor beneficial effects by relocating a portion of the Stehekin Valley Road and by improving the ability to retain other parts of the road (including near the mouth of the Stehekin River and at Boulder Creek, Frog Island, Wilson Creek, Milepost 8.0, and Milepost 9.2). Alternative 3 would contribute the same range of negligible to minor adverse impacts by relocating a shorter portion of the road and by instituting additional erosion protection measures (instead of a reroute) at Lower Field. Alternative 4 would institute similar erosion protection measures as Alternative 3, plus additional rock barbs at Mileposts 7.0 and 9.2, but would retain the road similar to Alternative 1. Therefore, it would have negligible beneficial effects on park operations because it is likely that future measures would continue to be needed, although not to the degree that they would in Alternative 1.

## Conclusion

Alternatives 1 - 5 would have some short-term adverse impacts (related to construction) and a series of long-term moderate to major beneficial effects on park operations from construction of the new energy-efficient, well-designed maintenance facility and housing areas. There would also be a series of minor to moderate adverse impacts associated with all alternatives from continued implementation of the 1995 LPP or from modifying it.

Impacts that would be different among alternatives on park operations would primarily have to do with the changes to the Stehekin Valley Road and from those related to implementation of erosion protection measures. Among the alternatives, Alternatives 2 and 5 would have the greatest long-term beneficial effects, followed by Alternative 3, Alternative 4, and then Alternative 1. These beneficial effects would primarily be related to the ability of the NPS to maintain the road, with the longer reroute and specific erosion protection measures in Alternatives 2 and 5 contributing to fewer routine and more cyclic maintenance operations. Alternatives 1 and 4 would have moderate to major adverse impacts on park operations by maintaining the Stehekin Valley Road through the floodplain at McGregor Meadows. Although Alternatives 3 and 4 would have the same array of erosion protection measures, moving the road away from the river in Alternative 3 would have greater long-term beneficial effects on park operations by relocating the road from an area of repeated maintenance needs to one of fewer needs over time. Alternative 4 would have fewer long-term impacts on park operations than Alternative 1, because there would be a variety of locations where erosion protection measures designed for keeping the road in place would be implemented. Although these would likely also occur eventually in Alternative 1, they are not planned and would therefore continue to need to undergo separate environmental analysis to implement, an impact that would affect future staff time.

## 22. Socioeconomic Impacts

### Socioeconomic Methodology

Socioeconomic effects include changes to patterns of consumption, the distribution of incomes and wealth, the way in which people behave (both in terms of purchase decisions and the way in which they choose to spend their time), and the overall quality of life.

This socioeconomic analysis focuses on the current and reasonably foreseeable socioeconomic effects that would result from the social and economic changes that may be caused by the alternatives considered in this plan. The Socioeconomic section in Chapter III: *Affected Environment* provides a broader array of socioeconomic data and supporting information. This information was included to provide a more comprehensive picture of the socioeconomic environment related to Stehekin. This more detailed section responds to public comments on the DEIS that were heavily focused on potential effect on Stehekin.

Only some of the topics and indicators discussed in the Socioeconomic section of Chapter III: *Affected Environment*, have been carried forward in this analysis. This impact analysis relies on the socioeconomic data and supporting information provided in Chapter III, and several assumptions in the beginning of this chapter, to evaluate how the various management alternatives in this plan could affect the socioeconomic environment.

*Socioeconomic Indicators:* The following suite of socioeconomic indicators is used to focus the analysis on specific factors or indicators that are relevant to the area to evaluate how specific management actions proposed in the SRCIP and Land Protection Plan (LPP) would potentially affect the socioeconomic environment. These indicators include:

1. Economic indicators including income and employment opportunities;
2. Social indicators including demographics and housing availability; and
3. Community asset-related indicators including public utilities, services and facilities and private land availability.

Public Health and Safety are often considered a socioeconomic indicator. This topic, however, is addressed as a separate impact topic in the section entitled “Visitor Experience: Safety Impacts.” In addition, potential impacts to routine patterns of daily life in Stehekin are discussed in the section entitled “Visitor Experience: Access and Transportation Impacts.”

**Context of Impact:** Socioeconomic impacts were considered primarily within Stehekin (local) and, when relevant, within Chelan County, Washington (regional).

**Type of Impact:** Beneficial impacts would improve the local or regional economy (such as increased income or job opportunities) and/or improve one or more of the socioeconomic indicators (such as an increase in population or increased access to housing). Adverse impacts would include economic impacts (such as a loss in income) and/or reduced availability or opportunity in one or more socioeconomic indicators (such as a decrease in population or housing availability).

Some impacts may be both beneficial and adverse at the same time. For example: increased property values would have an adverse impact on the homeowner at the time of paying property taxes but also have a beneficial impact in that they increase the homeowner’s wealth and Chelan County’s overall tax base. These types of impacts are defined as neutral.

**Intensity of Impact:**

- **Negligible:** Changes in socioeconomic indicators in Stehekin or Chelan County would not be measurable.
- **Minor:** Changes in the socioeconomic indicators would affect some individuals but would not be readily apparent within the larger population of Stehekin or Chelan County.
- **Moderate:** Changes in the socioeconomic indicators would be measurable but not overtly apparent in Stehekin and/or Chelan County. No new economic sectors would be created or eliminated and no major shifts would occur in the socioeconomic indicators due to actions in this plan.
- **Major:** Changes in the socioeconomic indicators would occur and would be readily apparent in Stehekin and/or Chelan County. New economic sectors could be created or eliminated. There would be major shifts in Stehekin population demographics and housing. Major community assets (services or facilities) would be added or removed.

## Socioeconomics Impacts

Except for cumulative impacts, the following topics discussed in Chapter III: *Affected Environment* will not be discussed in detail in this analysis because they would not be affected by the management actions considered in this plan:

- Demographics (age, gender, and race): this topic was considered but dismissed because none of the actions considered in this plan would affect the local or regional demographics. Instead, community demographics would continue to be influenced by broader economic and societal factors unrelated to NPS actions.
- Transportation and access to and from the Stehekin Valley: none of the management actions would change the manner in which landowners or visitors access Lake Chelan NRA.
- Telecommunications and utilities (electricity, water, septic): none of the management actions would affect these services.
- Service-based community assets including post office services, education services, medical emergency response services, law enforcement, fire management and protection, and community organizations: none of the management actions would affect these services.

### *Impacts from Alternative 1*

This section addresses the potential impacts of Alternative 1 as well as the Actions Common to All Alternatives, which are described in detail in Chapter II: *Management Alternatives*.

#### Income and Employment

Ongoing NPS administration of Lake Chelan NRA, including staffing, programs, and project expenditures would continue to contribute to the local economy of Stehekin and, to a lesser extent, to Chelan County.

**Ongoing Operations and Maintenance:** Income and employment opportunities would continue to be available from NPS operations and maintenance activities including trash hauling, road maintenance and emergency response. Generally, over the last several years, approximately 7 Stehekin Community residents were also employed by the NPS (J. Kurth, pers. comm. 2012). Similar employment levels would likely continue, although these could change associated with budget allocations.

Five Stehekin businesses (each marked with two asterisks in Table III-20) currently receive regular contracts from the NPS to provide routine operations and maintenance assistance, such as road maintenance and transportation services. Since 2006, the average annual gross income for local business derived from these contracts has been approximately $322,403 (Table III-21). The NPS has also periodically purchased services and supplies from other Stehekin businesses such as from several local carpenters (Welch, pers. comm. 2011). These sources of income and employment would continue to have a beneficial effect, however, the amount of income and employment that would be generated is difficult to quantify because future federal funding cannot be predicted. There would also likely continue to be indirect benefits for other non-construction businesses in the area. The impacts of income and funding from these projects would be beneficial, both short and long-term and negligible to moderate, on the local economy in Stehekin. The regional economy would also benefit, but the benefits would be negligible to minor given the much larger scale of the economy of Chelan County relative to the revenues derived from contracts with the NPS.

**Relocation of Maintenance Facility and Housing Area:** The largest source of potential project-related income to the local economy in this plan would be derived from the proposed relocation of the NPS maintenance facility and replacement of employee housing. This project is projected to cost approximately $13 million dollars for full project implementation, which would likely cover three phases. Phase I would relocate the maintenance facilities (equipment repair shop, fuel storage and dispensing facility, a search and rescue/fire cache building, storage building, solid waste compaction and recycling building, helipad and associated infrastructure) and replace one single family, three bedroom residence that needs to be removed due to flooding. Phases II and III would continue to replace employee housing, but funding has not been secured so these phases would not be implemented until after Phase I is completed. The construction of these facilities would be done through a contract for each phase. It is also possible that local Stehekin businesses or residents would be employed for portions of this work and this could benefit the local economy. Relocation and replacement of these facilities could provide a beneficial source of income and employment for several years for both businesses and individuals. It is anticipated that this project would be completed over approximately the next decade due to funding limitations.

**Stehekin Valley Road Improvement Project:** The next largest source of potential income would include funding the Stehekin Valley Road Improvement Project as originally proposed prior to the 2006 flood (NPS LACH 2005b). The total estimated cost for this project is $6.72 million. A substantial amount of this funding would be spent on contracts for construction and related services. It is possible that local businesses in Stehekin, or regional businesses would be involved in these contracts and could receive payment for services. These federal expenditures on road paving and repairs could provide some income for local businesses and individuals, and would provide or enable additional employment opportunities currently unavailable in the area. This would have a direct beneficial effect on businesses that offer construction-related goods and services, and could have an indirect beneficial effect on other businesses, such as housing rental, lodging, transportation, or food providers, as well.

Upgrading and surfacing the Stehekin Valley Road in its current location and alignment would leave the road (in some areas) substantially vulnerable to flood damage. Impacts to the transportation infrastructure would cause some businesses and individuals to lose income due to the direct and indirect effects of flooding on the primarily tourism-based economy of Stehekin. Potential scenarios for lost income could include a spring snowmelt flood just prior to the summer tourist season. Vulnerable sections of the Stehekin Valley Road could be damaged or destroyed, disrupting or preventing tourist access to popular areas of the valley, trailheads leading into the park and national forest and popular accommodations such as the Stehekin Valley Ranch, which is geographically isolated from the lower valley and requires road access through vulnerable areas such as McGregor Meadows. Loss of access on the Stehekin Valley Road could result in a range of adverse, short-term impacts to the tourism-based economy of Stehekin. These impacts could range from negligible to major depending upon the individuals and businesses affected and scale of flood damage on the transportation infrastructure.

**Response to Flooding:** The NPS would continue to respond to flood-related damage to its transportation and facility infrastructure, and some of this response would likely continue to include local contracts. Since 1990, the NPS has spent approximately $4.05 million in flood repair costs for the road infrastructure in the lower Stehekin Valley. This roughly equates to $200,000/year in repair costs. In Alternative 1, it is likely that these costs would continue because there would be few actions taken to reduce the risk of flood damage. These road repair costs could also possibly increase if there are continued increases in the magnitude and frequency of flooding. Because local contractors are often hired to assist with flood-related road repairs, future flood repairs would continue to provide income and potential employment opportunities for some businesses and residents related to road maintenance and construction services and some hospitality services. Not all businesses or individuals, however, would experience increased income from projects related to flood damage repair.

**Continued Implementation of the 1995 Land Protection Plan:** Continued implementation of the 1995 Land Protection Plan would provide income opportunities for private landowners seeking to sell or exchange their property to the NPS. For owners of property at risk of flooding, sale or exchange with the NPS could provide income that might not otherwise be available in the general real estate market because owners of property at risk of flooding could experience difficulty selling their property due to the flood hazard. Because the NPS is charged with protecting non-market based resources (e.g. wildlife habitat, free flowing waters and native biodiversity), the NPS is authorized by law to pay to protect these values, which are fundamental to the purpose of Lake Chelan NRA. Individual landowners seeking to sell their flood-threatened property to the NPS could experience negligible to major financial benefits, depending upon their personal financial circumstances. Based on the criteria provided in the methods section for this analysis, the impacts on the broader socioeconomic environment would be beneficial, but relatively minor given the limited amount of property the NPS is likely to acquire in the future based on the expected number of willing sellers likely to request either purchase or exchange. This conclusion is based on the limited number of willing sellers that have completed transactions (e.g. 3 parcels exchanged, 5 parcels acquired and 4 easements obtained) by the NPS in the last 15 years.

Some property owners may only be interested in selling or donating their property to the NPS so that it can become part of a unit of the National Park System. Over the years, several NPS land purchases and easement acquisitions have occurred for this specific reason. For these landowners, the ability to generate income through sale to NPS may not be the primary motivating factor. Instead, the nonmonetary benefits of transferring private land for public preservation purposes could be the motivating factor. These types of sales would likely continue under the 1995 Land Protection Plan, although relatively little acreage would likely be acquired given limited land acquisition funding and the high priority placed on acquiring or exchanging property to relocate development from the sensitive areas, including the floodplain / channel migration zone, wetlands and riparian areas.

Some comments on the DEIS regarding continued purchase of land in accordance with the 1995 LPP suggested that NPS purchase of private land would erode the property tax base and have adverse impacts on county revenue. NPS purchase of private land would reduce the amount of property tax revenue, but that amount of property tax revenue for the county would be negligible to minor for the following reasons. In 2011, approximately $130,000 in revenue was generated from property taxes received from the Stehekin Tax District. That same year, Chelan County collected approximately $78.63 million in revenue from a wide variety of sources, including property taxes and $2.13 million in Payment in Lieu of Taxes (PILT) money from the federal government (Table III-27) to offset tax revenue not collected from federal lands in the county. These data suggest that property tax revenue generated from Stehekin represent a very small fraction of overall county revenue. Reductions in property tax revenues from NPS acquisition of private lands would be minimal due to the relatively small amount of land willing sellers are likely to offer to the NPS for sale, and the relatively small amount of property tax paid on this land compared to overall county revenue.

### Public Services and Facilities

As in Actions Common to All Alternatives (including Alternative 1) the NPS would continue to contribute to various community assets (see Chapter III: *Affected Environment*, Socioeconomics, e. Community Assets.) This would include solid waste disposal; general road maintenance including snow plowing; long-term parking for landowners at Stehekin Landing; some limited private use of public water and sewer systems (for fee); the Stehekin shuttle; office space for the post office; wildland fire suppression and forest fuel reduction (including assistance to landowners); and some natural resources for domestic consumption including sand, rock, gravel and firewood. Provision of these services would continue to have long term, moderate to major benefits to the socioeconomic environment associated with the Stehekin Community.

### Private Property

**Road Grade Raise:** Implementation of the road improvement project as originally proposed (NPS LACH 2005a) would involve increasing the grade of the road through McGregor Meadows between Mileposts 6.25 - 6.53 and 6.95 - 7.14 to attempt to prevent loss of or damage to the road from flood scour and possible channel avulsion. These grade raises would prevent floodwaters from scouring the road but would not result in higher floodwater elevations or greater water velocity because they would be designed not to impound or impede the movement of water through the area during flooding. An indirect consequence of the road grade raise would have a minor and periodic benefit to private landowners in the vicinity of McGregor Meadows because the grade raise would enable access to and from their homes during and after minor flood events. The NPS has considered this scenario and used various sources of information to develop a map of the area, which represents the relative degree of risk or "urgency" of the threat of flooding (Figure i-11). This map indicates that the highest level of risk to the Stehekin Valley Road is at the southern end of McGregor Meadows, which is where one of the grade raises would be installed. Since this is also the point of entry for motor vehicles in the area, this action could beneficially affect motor vehicle access for 11 parcels of seasonally-occupied private property in the McGregor Meadows area. Two private parcels which are used for year-round residential purposes and provide important recreational services further upvalley at the Stehekin Valley Ranch, would also indirectly benefit from this action because it would enable continued motor vehicle access.

The road grade raise would help to protect the road, including access to private property, under minor flood conditions such as those that could occur during spring snowmelt. It would not help to protect the road, or access to private property, during a major flood event. If the road were substantially damaged by a major flood, which is reasonably foreseeable given the present circumstances, then loss of road access would also mean loss of motor vehicle access to private land within McGregor Meadows and the Stehekin Valley Ranch as well as recreational facilities in this part of the Valley. Under this scenario (loss of the road from a major flood) long-term loss of motor vehicle access could result, and pose significant challenges for the NPS to reestablish the Stehekin Valley Road, especially if the river were to carve out a new channel in the area. Loss of motor vehicle access could adversely affect property values, and result in other direct and indirect socioeconomic costs on landowners.

**Wilson Creek:** The proposed installation of riprap clusters and road modifications at Wilson Creek would require access across private property to install and maintain. These erosion protection measures would adversely affect approximately 1.5 acres of private land (some of which is currently submerged within the Stehekin River) from installation of the structures and from their localized effects on river hydrology. This action would therefore require authorization from the landowner, and compensation in the form of an easement or purchase from this private landowner. The NPS would pay fair market value for easement access, but this payment may not fully compensate for the non-market (e.g. sentimental) values the landowners ascribe to their property. The action would, however benefit the private landowner by helping to maintain motor vehicle access to their home.

If the NPS is unable to negotiate access for construction via easement or purchase, then continued erosion at this location could adversely affect the Stehekin Valley Road and could lead to the need for emergency repairs when the road is damaged or fails. As noted above, loss of the road would result in the loss of vehicle access to private property, private businesses, trailheads and other recreational facilities further upvalley. This would cause short-term adverse impacts to residents and visitors until a repair or reroute could be constructed. The magnitude of this adverse impact could range from negligible to moderate depending upon future flood severity, the length of time required to reconstruct the road, whether or not the damage disrupts access during the summer tourist season, and the number of individuals and businesses affected by the closure.

**Continued Maintenance of Existing Erosion Protection Measures:** Although the NPS is prohibited from taking action specifically to protect private land, under Alternative 1, continued maintenance of erosion control structures to protect Company Creek Road and the Stehekin Valley Road could collaterally protect private property in some areas (e.g. the vicinity of the Bakery and Silver Bay; and the middle and upper sections of Company Creek Road) by locally restricting the process of channel migration. These erosion protection measures, designed to ensure sustainable vehicle access, would restrict channel migration in some areas. Private property in the vicinity of these areas would indirectly benefit from these actions because the risk of channel migration, including the potential loss of property (e.g. houses and other development) during flooding, would be reduced in these areas.

**Continued Implementation of the 1995 Land Protection Plan:** Implementation of this plan would have little influence on property values for several reasons. According to Chelan County Assessor records, in the last 20 years, there have been 74 land transactions between private parties in Stehekin. This accounts for more than 91 percent of all land transactions (81 transactions) that have occurred (Figure III-18 *Land Transactions in the Stehekin Valley*). The NPS has been involved in approximately 9 percent of land transactions over this period of time. The vast majority of real estate transactions have taken place between private parties indicates a relatively low demand from property owners to sell or exchange their land with the NPS. It is anticipated that this trend would continue -- with the majority of land transactions continuing between private parties and a few with the NPS. Private transactions would continue to exert the primary influence over land values by establishing comparable sales values that would continue to be used by potential land buyers as the basis for determining market values. Similarly, these private land transactions would also be used by the NPS to determine Fair Market value for purposes of exchanges or acquisition (including easements.) Therefore, continued land acquisition under the guidance of the 1995 LPP is likely have a negligible to minor influence on land values.

Under Alternative 1, approximately 43 acres of land identified in the 1995 LPP would remain available for exchange. Priorities for land exchanges under the 1995 LPP would continue to focus on the highest priority lands being greater than one acre in size, and containing sensitive resources such as wetlands, areas of high visual sensitivity, riparian habitat and high flood influence areas. Over time, continued land exchanges could decrease the amount of private property in these sensitive areas and increase the amount of private property in upland locations not threatened by flooding. The overall effect of land exchanges on the location and relative abundance of private property, however, is likely to be small given the limited demand from property owners for land exchanges, despite three recent major floods.

### *Impacts from Alternative 2*

#### Income and Employment

As in Alternative 1, income and employment opportunities for the private sector would be generated by ongoing NPS administration of programs and projects within Lake Chelan NRA. Some of these program and project functions would be conducted under contracts with Stehekin businesses.

**Road Rehabilitation and Reroute:** This project is estimated to cost approximately $8.2 million and some of this funding would likely provide local income and employment opportunities. The beneficial impacts on income and employment would be similar to those in Alternative 1 from the rehabilitation of the Stehekin Valley Road, except that initial construction costs of rerouting the Stehekin Valley Road around McGregor Meadows and the Lower Field would be approximately $1.53 million more than in Alternative 1. Compared to Alternative 1, which would cost approximately $6.72 million, these additional project costs could provide slightly more employment and income opportunities, and therefore have some additional beneficial impacts for some businesses and individuals who may conduct this work under contract with the NPS. As in Alternative 1, these beneficial impacts could also extend to other businesses and individuals that may provide goods and services to contractors conducting the work, but because the project would potentially provide more local income and employment opportunities, it would provide slightly more benefits.

Following road construction, there would be long-term beneficial impacts from improving the sustainability of the road network in Stehekin to withstand impacts from flooding. Less risk of flood damage to the road network would help to ensure that visitors, employees and property owners have access to recreational facilities, visitor services, administrative facilities, and property in the lower valley, which would be substantially more consistent and certain compared to Alternative 1. This would help to sustain income and employment opportunities and provide long term, beneficial impacts to the tourism-based economy of the area.

**Implementation of 2010 Revised LPP:** Similar to Alternative 1, impacts associated to county revenues from changes in the property tax base would be minor because the rate of NPS land transactions is not likely to change as a consequence of revising the LPP to place greater emphasis on land exchanges within the channel migration zone, as opposed to just within the floodplain (as in Alternative 1) and because there would be less land available for exchange compared to Alternative 1. In addition, as noted in Alternative 1, the property tax revenues provided to the county are not likely to decline appreciably. For these reasons, there would be a negligible to minor adverse impact to county revenues from the proposed changes to the Land Protection Plan.

## Public Services and Facilities

**Road Rehabilitation and Reroute:** Upgrading and relocating a portion of the Stehekin Valley Road would provide a more sustainable and resilient road network than in Alternative 1. This would benefit the community by helping to sustain motor vehicle access in the lower Stehekin Valley.

**Shooting Range Closure:** The alignment of the road reroute around McGregor Meadows would require closure of the shooting range because the road would traverse the backdrop of the shooting range. Range closure would ensure public safety by eliminating the potential for bullets to harm users of the realigned road. Management Policies (NPS 2006) deter activities that release contaminants into the environment which in turn incurs a financial liability for clean up. As a result the NPS would not establish a new shooting range. Range closure would adversely affect some members of the community who use the range to sight their weapons, for general practice, and for hunter safety qualification purposes. However, this impact could be mitigated if a range were established on private property within the Valley, which county zoning allows and the NPS would not oppose provided that it did not pose a public safety issue.

**Fire Management Program (Fuel Reduction):** In recent years the NPS forest fuel reduction program has generated large quantities of easy to obtain firewood. As the forest fuel reduction program meets its goals of reducing fuel load the availability of easily obtained firewood will diminish. Some of the wood removed from the road reroute area could be used as firewood for personal use within the valley. This would generate firewood to meet demand for several years. This would have a short-term negligible to minor beneficial impact on residents, businesses and landowners in the valley that rely upon this resource for heating residences and businesses.

**River Access Point:** Construction of the river access point near the Stehekin River mouth would provide an additional public facility and this would have a minor beneficial effect for some visitors and valley residents. Some residents who live close the proposed river access point, however, may object to the changed pattern of public use in this area, including the potential for increased visitor use. The magnitude of adverse impact to residents in the vicinity of the river access point would vary on an individual basis, but is not likely to be major because the general area is already frequently used by visitors.

**Large Woody Debris:** Compared to Alternative 1, there would be long-term beneficial effects from the change in NPS policy regarding the procurement of large woody debris that would enable use of wood from the river for erosion protection purposes on private land with applicable authorization . The availability of large woody debris would help private landowners who choose to install "fish friendly" erosion protection measures or Advanced Flood Protection Measures (e.g. debris fencing) on their property in accordance with recent guidance provided by the Army Corps of Engineers (Appendix 7).

## Private Property

**Road Rehabilitation and Relocation:** In the vicinity of McGregor Meadows the Stehekin Valley Road reroute the NPS would continue to maintain motor vehicle access into McGregor Meadows until an event for which no reasonable measures could be implemented overrides the NPS ability to maintain continued motor vehicle access to the area. At that time, alternative motor vehicle access would be considered on a case-by-case basis. This approach would provide continued motor vehicle access from the road reroute, and therefore would not adversely affect property values or related uses. If a severe flood precluded motor vehicle access, up to 11 landowners in McGregor Meadows could be adversely affected. Some of these landowners, most notably those living in Urgency Zone 1, could lose motor vehicle access to and/or built structures on their property. Loss of access or property would have major adverse socioeconomic effects on affected landowners through reduced property values and associated economic loses. These effects, however, would not be caused by NPS management actions. Instead, they would be from large scale geologic changes, such as channel migration and aggradation naturally occurring in this depositional reach of the Stehekin River.

**Wilson Creek:** The proposed installation of rock barbs and road modifications at Wilson Creek would adversely affect one parcel of private land from the need to provide access to construct and maintain these. Similar to Alternative 1, this work would therefore require an easement or purchase from this private landowner, which could result in a short-term economic benefit similar to Alternative 1. If this easement or purchase was not possible, continued erosion at this location could result in damage or failure of the Stehekin Valley Road. This, in turn, could lead to temporary loss of vehicle access, a minor to moderate adverse effect on visitors, administrative use and property owners affected by the closure. In addition, emergency repairs would be needed that would likely be more expensive that the proposed project at this site.

**Stehekin River Mouth:** In contrast to Alternative 1, erosion protection measures near the mouth of the Stehekin River and in the vicinity of Boulder Creek would reduce the risk of flood scour and channel avulsion and enhance protection of the Stehekin Valley Road. Compared to Alternative 1, these actions could have an indirect benefit for private property in the vicinity of the Bakery and Silver Bay by further reducing potential flood damage. This densely developed area is a focal point for residential development and businesses that support the local Stehekin economy and tourism. Indirectly reducing the risk of severe flood damage would provide more long-term socioeconomic benefits to the property owners and businesses in the area, compared with Alternative 1, which would maintain existing structures but which would not proactively install additional measures to further reduce flood damage.

**2010 Revised Land Protection Plan:** Revisions to the LPP under Alternative 2 would place more emphasis on removing unsustainable development from both the floodplain and channel migration zone (CMZ) of the Stehekin River, or from the alluvial fan migration zones (AFMZ) of the tributaries to the Stehekin River by working with willing sellers who voluntarily decide to relocate from these areas. This change in priorities would enable the NPS to better compete for limited funding for land exchange or acquisition. In contrast, the current LPP, as described in Alternative 1 lacks this comprehensive focus because it does not include the channel migration zone and instead focuses on high flood influence areas. This static view of the flood threat does not acknowledge rapid channel changes that are likely to continue to occur. Compared to Alternative 1, the amount of acreage available for land exchanges would be reduced from approximately 43 acres to approximately 24 acres to avoid exchange of federal lands with sensitive resources and values that should be retained as public land. Based on the number of property owners that have approached the NPS in the last 20 years to explore land exchanges, and the number of property owners currently undergoing negotiations with the NPS, it appears that there is ample land available in the LPP to meet anticipated exchange requests. Over the last 20 years, three exchanges have been completed, involving approximately 12 acres transferred from the NPS to private landowners. Compared to the 1995 Land Protection Plan in Alternative 1, which does not take into consideration the potential threat of flooding on private development in the channel migration zone, the modifications under Alternative 2 could lead to long-term beneficial impacts for some landowners who choose exchange land with the NPS to avoid flooding.

There would also be indirect minor beneficial impacts from providing land outside of the floodplain for exchange that could, in turn, support safer, sustainable community development. This would provide sustainable locations for compatible residential and commercial development. These beneficial impacts, however, would be limited given the relatively small number of private property owners interested in exchange and the availability of funding to conduct exchanges and therefore, the limited number of land exchanges likely to occur within the lifespan of the plan, and the relatively large amount of private landowners that would choose to remain in the channel migration zone.

Similar to Alternative 1, property values would be unlikely to be affected by NPS acquisition activity. Instead, real estate sales among private parties would continue to dominate the real estate market and have the primary influence on land values by establishing the majority of comparable sales values used by potential buyers, including the NPS, to inform the appropriate market value.

### *Impacts from Alternative 3*

#### Income and Employment

Impacts would be similar to Alternative 2, although there would be slightly more spending on road-related projects ($9.76 million versus $8.25 million), which could translate into slightly more income and employment benefits for businesses and individuals who may receive contracts or otherwise benefit from increased demand for goods and services.

As in Alternatives 1 and 2, income and employment opportunities for the private sector would be generated by ongoing NPS administration of projects within Lake Chelan NRA. This would continue to include those program functions conducted under contracts with Stehekin businesses.

**Road Rehabilitation and Reroute:** The beneficial impacts on income and employment would be similar to those in Alternatives 1 and 2, except that initial construction costs of rerouting the Stehekin Valley Road around McGregor Meadows combined with road rehabilitation would be approximately $1.51 million more than in Alternative 2 and $3.03 million more than in Alternative 1. As a result, beneficial impacts would be short-term and minor to moderate, similar to Alternative 2. Other beneficial impacts from the road reroute would be the same as in Alternative 2.

**Implementation of 2010 Revised LPP:** As in Alternatives 1 and 2, adverse impacts to Chelan County revenues from reductions in the property tax base would be negligible for the same reasons described under Alternative 2.

#### Public Services and Facilities

**Road Rehabilitation and Reroute:** As in Alternative 2, upgrading and relocating a portion of the Stehekin Valley Road around McGregor Meadows would provide a more sustainable and resilient road network than in Alternative 1. This would benefit the community in general by helping to sustain motor vehicle access in the lower Stehekin Valley. The road reroute as proposed in Alternative 3, however, would be slightly shorter than Alternative 2, and this shorter alignment would avoid the potential for adverse impacts under Alternative 2 associated with closing the shooting range.

Similarly, potential beneficial effects associated with the provision of firewood would be the same as in Alternative 2; however, because there would be fewer trees removed, there could potentially be less availability, depending on for what other purposes the wood was designated.

**Large Woody Debris:** Compared to Alternative 1 but similar to Alternative 2, there would be long-term beneficial effects from the change in NPS policy regarding the procurement of large woody debris that would enable use of wood from the river for erosion protection purposes on private land (with applicable federal, state and/or local permits if working in water and/or within the shoreline environment). The availability of large woody debris for local use would also help private landowners who choose to install Advanced Flood Protection Measures such as Flow Deflection Barriers or Debris Fences in accordance with recent guidance provided by the Corps of Engineers (Appendix 7). Large woody debris would also help landowners seeking to substitute habitat friendly erosion protection measures. Advanced Flood Protection Measures were designed for implementation without permits.

### Private Property

**Road Rehabilitation and Relocation:** Similar to Alternative 2, the Stehekin Valley Road would bypass McGregor Meadows, but motor vehicle access into the area would continue to be maintained. In contrast to Alternative 1, which would raise the road grade to minimize flood scour, the road grade would not be raised into McGregor Meadows and this would preclude access to private property during flooding. Although there are no primary residences in this area, loss of motor vehicle access during and following a flood could adversely affect the property owners. Similar to Alternative 2, the impacts would vary from short-term during a minor flood event, to long-term if a major flood event caused severe scouring of the road and eliminated the possibility of providing motor vehicle access via that route. If access was lost, alternative access would be considered on a case-by case basis. Some property owners, such as those living in the highest risk zone within the area (Figure i-11) could potentially lose motor vehicle access, and this would adversely affect property values.

The proposed installation of rock barbs and road modifications at Wilson Creek would adversely affect one parcel of private land from the need to access the Stehekin River bank in this area. Impacts of this action would be similar to Alternative 2.

Erosion protection measures near the mouth of the Stehekin River and construction of a river access point could reduce the risk of flood scour and channel avulsion to protect the Stehekin Valley Road. These actions could also indirectly benefit private land and housing in the vicinity of the Bakery and Silver Bay. This area is a focal point for residential development and businesses that support the local Stehekin economy and tourism. Indirectly reducing the risk of severe flood damage would provide long-term benefits to the property owners and businesses in the area.

**Stehekin River Mouth:** Similar to Alternative 2, erosion protection measures near the mouth of the Stehekin River and downstream of Boulder Creek would reduce the risk of flood scour and channel avulsion to protect the Stehekin Valley Road. These actions could also indirectly benefit private land and housing in the vicinity of the Bakery and Silver Bay. This area is a focal point for residential development and businesses that support tourism and the local Stehekin economy.

Indirectly reducing the risk of severe flood damage would provide long-term benefits to the property owners and businesses in the area.

**Wilson Creek:** Impacts would be the same as in Alternative 2 except that instead of rock barbs, a logjam would be used.

**2010 Revised Land Protection Plan:** Similar to Alternative 2, the revisions to the LPP would provide the same potential beneficial impacts to landowners who choose to exchange land threatened by flooding with the NPS. Landowners whose property is identified as a high priority for exchange or who seek to voluntarily sell their property to the NPS could experience beneficial effects from NPS purchase of land threatened by flooding. Similarly, there would be the same negligible to minor beneficial impacts from locating or moving development out of the channel migration zone. As in Alternative 2, land values would remain unaffected by NPS exchange or acquisitions because private transactions would continue to dominate the real estate market and substantially influence market values.

### *Impacts from Alternative 4*

#### Income and Employment

As in Alternatives 1-3, income and employment opportunities for the private sector would be generated by ongoing NPS administration of projects within Lake Chelan NRA. This would continue to include those program functions conducted under contracts with Stehekin businesses.

Compared to Alternative 1, actions under Alternative 4 would cost more, although these costs would be less than in Alternatives 2 and 3. Therefore impacts on income and employment from road-related projects would be greater than Alternative 1 but less than Alternatives 2 and 3.

Alternative 4 would have the greatest number of erosion protection measures, which would afford broader protection to the existing road network and possibly minimize the impacts of flooding on public facility and transportation infrastructure, and help to enable the continued flow of goods and services, including tourism. Compared to Alternative 1, there would be long term beneficial impacts on tourism and commerce. The degree to which these measures would prevent flood damage over time would be uncertain because retention of the road in McGregor Meadows would likely require additional erosion protection measures in the future and future funding for these would be uncertain. In addition, ongoing natural processes such as flooding, channel migration, channel aggradation could prevent the ability of the NPS to maintain the road network in its current location, especially in the most vulnerable areas. Over time, a reasonable foreseeable scenario could include adverse impacts to the local economy through loss of tourist revenues and related effects caused by the NPS' inability to protect the road infrastructure in place.

#### Public Services and Facilities

Impacts would generally be the same as in Alternatives 1-3 regarding ongoing NPS operations and contributions to community assets. Compared to Alternative 1, the road network would receive added erosion protection measures. These measures would be greater than in Alternative 1 and different from Alternatives 2 and 3 in that no reroute around McGregor Meadows or the Lower Field would occur. As noted in Alternative 1, over time it is unlikely that the Stehekin

Valley Road in the vicinity of McGregor Meadows could be maintained in its current location. Eventually channel aggradation and channel migration in this area could increase flood damage and render the road unusable. If this occurred, it would require road relocation to maintain vehicle access into the upper part of Lake Chelan NRA and the south unit of North Cascades National Park. Therefore, these measures would of limited use in maintaining the road network and sustaining long-term motor vehicle transportation in the lower valley, which is necessary to provide public services and facilities. This would result in short-term beneficial effects, followed by eventual adverse effects from flood damage, channel aggradation and channel migration.

#### Private Property

Similar to Alternative 1, private property within McGregor Meadows would indirectly benefit from the road grade raise because this action would help to sustain motor vehicle access to private property in the area. Elsewhere in the lower valley, erosion protection measures would improve the ability to sustain the flood-prone parts of the Stehekin Valley Road. As noted above, however, additional measures would likely be required in time. Retaining the road in place would likely be indirectly beneficial to private property and housing because there would be fewer high priority properties for exchange or acquisition. As in Alternative 2, the installation of rock barbs and an access road would require an easement or purchase from a private landowner and would affect erosion of this same private parcel downstream.

Although implementation of the revised LPP would affect the prioritization process for entering into land exchanges and acquisitions in a different way than in Alternatives 2 and 3, the net effect would likely be similar because of the small number of NPS land transactions compared to the larger volume of private land sales that are likely to influence market values and land availability in Stehekin.

### *Impacts from Alternative 5*

#### Income and Employment

As in Alternatives 1-4, income and employment opportunities for the private sector would be generated by ongoing NPS administration of and projects within Lake Chelan NRA. This would continue to include those program functions conducted under contracts with Stehekin businesses.

**Road Rehabilitation and Reroute:** Impacts associated with road rehabilitation and implementation of the McGregor Meadows / Lower Field reroute would be the same as described in Alternative 2. In addition, there would be slightly more beneficial impacts from constructing the Reroute Access Connector (spur road), which would provide visitor and landowner access to McGregor Meadows pending a washout of the McGregor Meadows Access Road.

**Implementation of 2012 Revised LPP:** Although the priorities for land exchange from willing sellers under this LPP would be different than in Alternative 2, there would be similar benefits. As in other alternatives, the potential impacts to Chelan County revenue from slight reductions in the property tax base would be negligible because Stehekin comprises a very small percentage of overall revenues.

To respond to public comments, this alternative also includes setting aside public land for a potential exchange with the Stehekin School District. This could be used to provide housing which in turn would help to attract a high quality teacher for the District. This action, if implemented by the School District would have a negligible to minor long-term beneficial effect.

### Public Services and Facilities

Impacts would be similar to Alternative 2. In addition, landowners and others needing access to to McGregor Meadows would benefit from construction of an alternative access road into the area. In addition, the provision of land for the Stehekin School District would contribute to a more sustainable school, directly benefitting the community as a whole.

### Private Property

**Road Reroute:** Impacts would be similar to Alternative 2, except that the NPS would construct an access road leading into McGregor Meadows from the realigned Stehekin Valley Road (Reroute Access Connector). This access road would enable maintenance of proposed new grade control structures at Milepost 7.0. It would also maintain motor vehicle access into the area after the existing road is damaged or lost as a result of flooding, a reasonable foreseeable impact. In addition, the added grade control structures at Milepost 7.0 could inadvertently protect private property by reducing the risk of scouring and channel avulsion toward the Stehekin Valley Road during flooding. These actions, while proposed to protect the road access for administrative and public use, would inadvertently protect property values in the near term. Over time, however, the flood risk in McGregor Meadows would remain, potentially overriding these initial indirect benefits on private property.

**Wilson Creek:** As in Alternative 2, the installation of rock barbs and an access road would require an easement or purchase from a private landowner and would affect erosion of this same private parcel downstream. As in Alternative 2, failure to obtain this easement could result in the road being temporarily closed due to damage from flooding. This in turn would have short term impacts to visitors, NPS employees and property owners until repairs can be made.

**Relocated NPS Housing:** The proposal to disperse some employee housing throughout the community responds to public comments but would have neutral benefits for private land because individual landowners within the Stehekin Community would be affected in different ways. For example, the views or experiences of some landowners could be adversely affected if new employee housing were constructed on adjacent land. Others could benefit from the added social dimensions of dispersing NPS housing among private land in the community. Because the specific locations for this dispersed housing have not yet been identified and because this proposal would undergo additional analysis and public and NPS review, additional effects are beyond the scope of this plan and would be addressed in subsequent environmental impact analysis.

**Revised 2012 Land Protection Plan:** Changes in the priorities for the Land Protection Plan would emphasize flood prone areas. The net effect to the socioeconomic environment would be similar to Alternative 2 because demand from willing sellers would be unlikely to change regardless of the distinctions in priorities.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts to the socioeconomic environment would include the following:

- Where possible, projects would be combined or phased to allow for cost-saving measures related to staging remaining in place, rather than setting up and taking down for sequential implementation actions.
- New buildings would be constructed to silver or greater LEED standards to minimize long-term operations costs, including electrical demand, which is already beyond capacity at times in summer.
- New buildings and facilities and other improvements would use recycled or reused materials to the extent possible.

## Cumulative Impacts

Income and Employment: The tourism-based economy of Stehekin would continue to be influenced by broad economic and social trends unrelated to NPS administration of Lake Chelan NRA. The recent recession, increased gas prices, and many other broad economic factors are all likely to substantially influence tourism-based demand for the area. These broader market fluctuations may have adverse effects. For example, as illustrated in Table III-22, the various costs associated with a two night stay in Stehekin for a family of two roughly range from as low as $119 to as high as $951. Transportation and lodging are the most expensive factors associated with these travel costs. Increased fuel prices are reasonably foreseeable, and this could reduce visitation to the area. Costs for existing lodging could also be affected in the near term due to inflationary factors (costs of labor, supplies, energy, etc), which would presumably be passed on to the consumer. Beyond these reasonably foreseeable effects, there are many possible economic and social trends that may cumulatively influence the tourism-based economy of Stehekin. Because of this, there is insufficient information to draw conclusions in this analysis.

Aside from broader economic and social influences that may affect tourism within the local area, the pending cleanup of the Holden Mine superfund site would likely have a cumulative influence on the socioeconomic environment. Cleanup of this superfund site, which lies on U.S. Forest Service land several miles southwest of Lake Chelan NRA, is estimated at $107 million, although those costs could be higher (USDA Forest Service 2012). Major work for this project is slated to begin in 2013, which is roughly the same timeframe that construction on the Stehekin Valley Road Improvement Project could also take place. Like Stehekin, Holden is an isolated, remote area that depends upon many of the same businesses that provide transportation, goods and services for Stehekin. The cumulative effects of this project on income and employment and the actions proposed in this plan would likely be minor to moderate and beneficial for some businesses and could last for several years.

When the effects of the alternatives (1-5) are combined with the above actions, there would be negligible to moderate cumulative beneficial effects from income and employment related to ongoing management of Lake Chelan NRA from continued implementation of NPS programs and operations. In addition, relocation of the NPS maintenance and housing facilities, which is anticipated to be completed over several phases, involving more than five years (though whether these phases would be contiguous is unknown). Under Alternatives 1 and 4, however, there would also be cumulative (periodic) adverse impacts on income and employment combined with limited beneficial impacts from periodic flood-induced closure of the Stehekin Valley Road due to retention of the parts of the road in the floodplain / channel migration zone. Closure events would result in beneficial impacts on income and employment from the need to repair the road, but would have adverse effects on other sectors of the tourism-based economy if flooding and/or road closures discouraged visitation to the area.

Because the implementation of most proposed projects under Alternatives 1-5 would be unlikely to last beyond a few years, there would be few cumulative effects from these actions. In Alternatives 1 and 4 this would include the implementation of the road grade raise and rehabilitation of the Stehekin Valley Road. In Alternatives 2, 3 and 5, this would include the road reroute and rehabilitation of the Stehekin Valley Road. Because of the road reroute and rehabilitation, there would be fewer cumulative beneficial impacts on the local economy generated from road maintenance and flood repairs because the rehabilitated road would be more resistant and resilient to flood damage. The ability to withstand impacts from flooding would have a minor to moderate cumulative beneficial effect on the local economy by ensuring the consistent flow of goods and services and improved access for visitors and property owners.

### Demographics

The recent 2010 census data indicate a relatively high "vacancy" rate (Table III-19) and high percentage of property ownership by non-Stehekin residents. These data show a relatively high percentage of properties and associated housing are used as vacation homes. The upward trends in vacancies (Figure III-16) may have a cumulative influence on the availability of housing in Stehekin and the demographics of the area. It is unclear if this trend could mean that more housing would be available for rent, or if as housing stock grows and properties change hands whether there would be a continued increase in the use of properties as vacation homes. This could have other influences on demographics such as fewer year-round residents, fewer families with young children (which could affect school enrollment), and perhaps affect other less tangible social values, such as the sense of community cohesion. If these trends continue, these changes could have negligible to moderate adverse, cumulative impacts on the character of the closely-knit Stehekin Community. The magnitude of this impact would ultimately depend upon individual values. For example, year round residents of the community may find these trends more adverse than property owners who occasionally visit the area.

Land exchanges would benefit the community by enabling property owners to voluntarily move out of the floodplain to more sustainable land that is not threatened by flooding or other geologic hazards. The NPS assumes that land exchanged would be developed to the extent allowed by county zoning and covenants, conditions and restrictions specific to each parcel. It is not known if future exchanges would result in year round residential use or part time vacation home use. Use of private property as either year round resident or part time vacation property is beyond the jurisdiction of the NPS, but is within the jurisdiction of Chelan County.

Effects from implementing Alternatives 1-5 would have no cumulative effects on demographics because impacts of hiring personnel for projects would only have short-term consequences associated with workers who may reside in the area for a short-term period while a project is being constructed.

Cumulative impacts to demographics would be similar to Alternative 1.

## Public Services and Facilities

The NPS would work to come into compliance with federal and state regulations regarding the handling and disposal of solid waste within Lake Chelan NRA. Options for future solid waste disposal could include having Chelan County or a private contractor assume operation of solid waste disposal. There is uncertainty regarding how waste disposal expenses would be covered in the future. As a result, it is reasonable to presume that waste disposal services would continue to be available for the community, but information is presently unavailable to determine the potential magnitude of financial impact that could result if the NPS no longer funds this service.

Aside from changes to NPS provided services, there are few reasonably foreseeable changes to non-NPS provided public services and facilities in the area. The recent proposal by the U.S. Postal Service, to close the Stehekin Post Office, if implemented, would have had an adverse cumulative impact on socioeconomic conditions, but this proposal was rescinded by the Postal Service.

State regulations presently only allow a single ferry operator, the Lake Chelan Boat Company, to provide public ferry service on Lake Chelan. A lawsuit challenging this regulatory constraint has recently been filed in U.S. District Court. The lawsuit proposes to secure the ability to operate an additional ferry on Lake Chelan, based in Stehekin, to provide more convenient transportation from Stehekin to Chelan. Given the remote, isolated nature of Stehekin, and that the primary means of access to the area is via the commercial ferry, this lawsuit could have substantial implications for the local economy of Stehekin if the plaintiffs prevail. According to the Washington Utilities and Transportation Commission, if commercial ferry service operation is exempted from regulation, then the Lake Chelan Boat Company would no longer have exclusive operating rights in a specific territory and other providers could apply to serve that route. This exemption would mean that the ferry rates and terms of service would no longer be regulated. This could have a profound effect on customers. There is disagreement over what the potential consequences may be, hence the litigation. Participants in the litigation believe this could result in increased or reduced services. The outcome of the litigation could have beneficial to adverse effects on the local and regional economy given the very limited options for transportation to Stehekin, and already high travel costs for tourists to the area. Until the lawsuit is resolved there is no reasonable way to determine cumulative socioeconomic implications.

When these actions are added to the effects from the alternatives, there would likely be minor adverse or beneficial cumulative effects on public services and facilities under all alternatives (1-5). In addition, there would be ongoing minor cumulative adverse effects under Alternatives 1 and 4 from reduced public services associated with periodic closure of the Stehekin Valley Road during flooding. In Alternatives 2, 3, and 5, there would be minor to moderate cumulative beneficial effects from reduced effects of flooding associated with the rerouted Stehekin Valley Road because it would be better able to withstand flooding.

## Private Property

The NPS is required by law to pay "fair market value" when acquiring private property. This value is established through an independent appraisal that must conform to detailed procedures promulgated by the Department of Justice that are more rigorous than a standard realty appraisal. In contrast, prices paid by private consumers are not constrained by the federal appraisal process but instead reflect the value to the individual purchaser.

Analysis of real estate sales in Stehekin over the last 20 years indicates the NPS has been involved in only about 9 percent of all transactions, whereas transactions among private parties have accounted for slightly more than 91 percent of all the land transactions. These data, combined with requirements of federal appraisals to use comparables, strongly suggest that the NPS is unlikely to have more than a negligible influence on property prices compared to the private sector influence. This trend is likely to continue given the relatively minor amount of NPS land purchase activity that is likely to occur in the future.

One exception to this general conclusion could occur with respect to NPs purchase of private land within the floodplain of the Stehekin River. Under these circumstances, the NPS may be the only buyer of land in flood threatened areas. This situation could arise because the NPS may be willing to pay for non-market values such as riparian habitat protection or water quality protection, whereas a prospective buyer may avoid purchase due to the risk of flooding. This could cumulatively influence the market value of land within the floodplain, and establish a higher market value than might otherwise be paid if the NPS were not engaged in real estate acquisition. The impact of this on land values is likely to be small, however, because of the limited number of real estate transactions between the NPS and willing sellers that is expected to occur. When a private landowner approaches the NPS to consider purchase of their land, the property owner is free until closing to sell their land to anyone else. NPS responses to landowner requests for acquisition therefore do not reduce land available for sale in the private market. Instead this reflects a choice made by the landowner as to the disposition of their property. As is evidenced in most real estate markets, limited land for sale coupled with continued demand often causes a rise in property sale prices. Private property values are also affected (generally increased) by proximity to undeveloped park land. Given these factors, it is reasonable to presume that property values will rise (as they do elsewhere) but the principal reason will be because of the proximity to federal park land.

The first 5 years after the establishment of Lake Chelan NRA (1968 through 1973) marked the period of time when the vast majority of private property in Stehekin was acquired. This intensive phase of acquisition was in response to development threats, such as logging and large scale subdivision facing the area at that time. In contrast, relatively little acreage has been acquired in the last decade (Figure III-18). As noted above, data on real estate transactions also indicate from 1992 through 2011, the NPS was responsible for slightly less than 9 percent of all real estate transactions in the Stehekin Area and private party transactions accounted for more than 91 percent of all transactions. Given (a) the limited interest from willing property owners to sell to the NPS; (b) limited funding available for land acquisition; (c) the independent, intensive appraisal process by which NPS acquisitions must occur; and (d) the relatively small percentage of land purchase activity on the part of NPS relative to the private sector, continued implementation of the 1995 (Alternative 1), revised 2010 (Alternatives, 2-4) or revised 2012 (Alternative 5) Land Protection Plan is likely to have a negligible cumulative influence on property values by slightly decreasing the amount of available private land, and influencing land values by reducing supply. In contrast, activity within the broader real estate market, including market demand for private property adjacent to federal park land is likely to have a major impact on property values.

Current zoning for the area enables some private land to be subdivided into additional parcels that would be available for residential use, either as a primary residence or as a second home for seasonal residents. Landowner decisions to subdivide land in accordance with current zoning would not be affected by NPS management actions, but could cumulatively add more development (including housing and potentially small business) to the Valley.

In all alternatives there would be indirect cumulative beneficial effects on private property from adding erosion protection measures to protect public facilities that would also minimize the likelihood of washouts in other areas. These effects would be greatest in Alternative 4, followed by 3, 5, 2 and 1.

## Conclusion

### *Impacts Common to All Alternatives*

#### Income and Employment

Implementation of projects identified in the alternatives (such as relocating the NPS maintenance and housing facilities and rehabilitating the Stehekin Valley Road in all alternatives or improving recreational facilities) would have direct and indirect, beneficial short term impacts on income and employment opportunities. These would be greatest in Alternatives 2, 3 and 5 and fewest in Alternatives 4 and 1.

Continued implementation of NPS programs and operations would have direct and indirect, long-term benefits on income and employment opportunities.

**Cumulative:** Cumulative beneficial impacts on income and employment would result from other economic activity in the vicinity of Stehekin, most notably including the costly cleanup of Holden Mine.

Continued NPS acquisition of private land is likely to have a negligible to minor, beneficial cumulative effect on individual income derived from private land sale to the NPS. Cumulative effects on property values are likely to be negligible since the private sector dominates purchase and sale activity in Stehekin.

Ongoing land exchanges would have a minor beneficial impact.

#### Demographics

**Cumulative:** There would be long term, cumulative effects on demographics associated with broader changes in society, as may be reflected in the increasing trend toward property ownership for seasonal or occasional use as opposed to primary residency. These changes could have adverse consequences for the closely-knit Stehekin Community.

#### Income and Employment

Alternatives 1 and 4 would continue to result in periodic damages to the transportation infrastructure and this would have periodic long-term adverse impacts to the local economy of Stehekin. These impacts would range from negligible to major depending upon the magnitude of flood damage and the resultant effects on tourism.

**Cumulative:** In time, the effects of geologic processes such as channel migration and aggradation could override measures to defend the Stehekin Valley Road in place. This could have minor to major cumulative adverse effects on tourism.

### Public Services and Facilities

Continued provision of various NPS funded services would provide long term, moderate to major benefits to Stehekin.

Continued flood damage would adversely affect the NPS' ability to provide and maintain the road infrastructure.

**Cumulative:** The change in solid waste handling could shift so that costs are borne by users.

Deregulation of the ferry system on Lake Chelan could have a cumulative adverse effect on the cost and timeliness of transportation services to and from Stehekin.

### Private Property

Maintenance of erosion control structures would indirectly and unintentionally benefit private property by reducing the risk of channel migration in some areas.

Continued NPS acquisition of private land is not likely to affect property values because the NPS anticipates limited land acquisition in the future, and private land sales dominate the real estate market in Stehekin. Impacts Common to Alternatives 1 and 4

Raising the road grade through McGregor Meadows would have adverse impacts to private property owners between the road and the river by increasing risk of flood damage. There would be beneficial impacts to property owners away from the river by reducing the flood risk.

## *Impacts Common to Alternatives 2-5*

### Income and Employment

There would be more project money spent on relocating and upgrading the Stehekin Valley Road to withstand flood damage, and this would have slightly more short term beneficial effects for local contractors, businesses and individuals. The cost and therefore the benefits of these alternatives would be greatest in Alternatives 2 and 5, followed by Alternatives 3 and 4.

Long term effects would be more beneficial than Alternative 1 because the transportation infrastructure would be located in a more sustainable location, and more protected from flooding compared with current conditions. This would have long-term beneficial effects on the tourism based economy of the area.

### Public Services and Facilities

The upgrade and relocation of the Stehekin Valley Road would have a beneficial impact on the quality and capacity of the road to withstand flooding and provide motor vehicle use for visitors, administrative use, landowners and the Stehekin Community.

Landowners could use wood from the river for permitted erosion protection and advanced flood protection measures, a long-term beneficial effect on individual landowners and the community.

In the near term the supply of firewood in the valley for heating purposes would be augmented by wood generated from relocating the Stehekin Valley Road. This would benefit the community by helping to ensure a sustained supply of firewood for several more years.

#### Private Property

Landowners between the road and the river in McGregor Meadows would not be affected by the added impacts of flooding associated with raising the road grade and proposed in Alternative 1.

There would be more erosion protection measures compared with Alternative 1, and this would indirectly benefit landowners in the vicinity of these structures. Most notably, the area in the vicinity of the head of the lake would experience indirect benefits such as reduced risk of flood damage.

There would be long term benefits to landowners seeking to relocate from flood prone areas.

Similar to Alternative 1, property values would primarily be influenced by activity in the private sector, which dominates the real estate market in Stehekin.

### *Additional Impacts of Alternative 1*

#### Income and Employment

Implementing the Stehekin Valley Road improvement project as originally proposed would have direct and indirect, beneficial short term impacts on income and employment opportunities.

### *Additional Impacts of Alternatives 2, 4 and 5*

#### Public Services and Facilities

Construction of the raft takeout near the mouth of the river would create an additional recreational facility that would benefit the community.

### *Additional Impacts of Alternative 3*

#### Private Property

Alternative 3 would generally have the same impacts as Alternative 2, however, there would be slightly more indirect beneficial effects to the private property and businesses in the vicinity of erosion protection measures and slightly less from a shorter reroute, leaving land adjacent to the road in the Lower Field within the floodplain / channel migration zone.

### *Additional Impacts of Alternative 4*

#### Public Services and Facilities

Impacts would be similar to Alternatives 2 and 3 for at least some time. However, at some point in the future, the benefits of erosion protection measures might be offset by channel migration and aggradation.

### Private Property

This alternative would have the greatest capacity to protect private property as an indirect consequence of erosion protection measures intended to protect public facilities including the road network.

#### *Additional Impacts of Alternative 5*

### Public Services and Facilities

There would be additional benefits to private landowners in the vicinity of McGregor Meadows associated with the added grade control structures and the provision of an alternative access route into the area to enable motor vehicle access, as opposed to access on foot, which could eventually be necessary under Alternative 2 until new access from the reroute was constructed.

### Private Property

The addition of two exchange parcels and the ability for the Stehekin School District to exchange for the parcel nearest the school would provide additional minor beneficial effects.

# 23. Hazardous Materials Impacts

## Hazardous Materials Methodology

The extent to which hazardous materials are present and would be exposed to visitors, personnel, and the environment under each alternative during site preparation, site management, or from any residual concentrations of hazardous substances was considered. Areas within the proposed project area that could require additional assessment and characterization for potential sources of environmental contamination were also identified.

**Type of Impact:** Generally, the addition of facilities and infrastructure that require hazardous materials that have a potential to expose people to greater levels of risk was considered adverse. Specifically, the type of impact would be considered adverse if it increased the quantity or type of hazardous materials used on the site or if it increased the frequency of use or number of people required to use these materials. Beneficial impacts would have a reduction in the presence or use of hazardous materials.

**Intensity of Impact:**

- **Negligible:** Impacts would be imperceptible or not detectable. There would be no or minimal exposure to hazardous materials.
- **Minor:** Impacts would be perceptible but localized in a small portion of the project area, without the potential to expand if left alone. Exposure to hazardous materials would occur only for those used to working with these materials.
- **Moderate:** The potential for hazardous materials would be widespread throughout the project area or within a specific portion of the project area. Hazardous materials surveys would be required before the extent of impacts was known. Professionals would be required to remediate potential contamination.

- **Major:** The potential for hazardous materials would be widespread throughout the project area. Hazardous materials surveys have identified serious problems. Professionals would be required to remediate potential contamination.

## Impacts from Hazardous Materials

### *Impacts from Actions Common to Alternative 1 - 5*

Some older buildings that would be demolished as a result of removing structures from the former maintenance area and flood-affected structures may contain hazardous building materials. The most common hazardous materials found in older buildings are asbestos, polychlorinated biphenyls (PCBs), and lead-based paint. Other hazards would result from septic system drain fields and tanks. Potential hazards of these materials stem from improper handling or disposal. If any unidentified hazardous building materials were to remain in existing buildings, these materials could cause adverse health impacts if human exposure were permitted during renovation. Construction workers and future employees or visitors could be exposed to contaminants in buildings to be renovated, or they could inadvertently expose the public or the environment to those contaminants. Hazardous materials could also be inappropriately released to the environment as hazardous waste or contamination.

In addition to impacts from hazardous materials associated with buildings, additional impacts associated with the removal of the former maintenance area have the potential to occur in Alternatives 1 - 5. Although recent practices regarding fuel spills and disposal of other hazardous materials have been improved, past practices may have contributed to the presence of hazardous materials near buildings and structures in the maintenance area, a long-term localized negligible to moderate adverse effect. Removal of fuel-storage facilities from within the 500-year floodplain would have a major beneficial effect. Additional hazardous materials would likely be present from the removal of the shooting range in Alternatives 2 and 5. Potential impacts from hazardous materials would be dealt with according to existing law and policy, which govern the need to survey and treat these areas and for personal protective equipment to protect NPS and contract employees from exposure hazards.

### *Additional Impacts from Alternatives 2 and 5*

Because the existing shooting range would need to be removed in Alternatives 2 and 5, there could be additional potential short-term minor adverse impacts from removal and long-term moderate beneficial impacts from mitigation of hazardous materials. These impacts would include the removal of potentially lead-contaminated soil from within the shooting range to an appropriate disposal location outside Lake Chelan NRA. During the removal, workers would potentially be exposed to soil contaminated with lead and potentially other materials, a minor adverse impact if precautions are taken. There would be long-term minor beneficial effects and long-term minor adverse effects at the disposal site from the removal of contaminated soil.

## Measures to Avoid, Minimize, or Mitigate Impacts

Measures included in the proposed project (as appropriate to the alternative actions) to minimize impacts from hazardous materials would include the following BMPs:

- Conducting formal surveys of the existing maintenance area, including contacting staff to determine if any unanticipated spill or disposal areas are present before removal of buildings or structures and associated development.
- Wearing proper personal protective equipment for the nature of the hazardous materials identified in the surveys during all work in the affected area.
- Refueling vehicles and equipment at least 100 feet from the river and its tributaries or other bodies of water.
- Identifying areas where refueling or maintenance of equipment would occur and providing containment devices, such as temporary earth berms, surrounding these areas.
- Ensuring that spill cleanup materials, such as absorbent pads, are present on site where needed.
- Requiring restrictions on the location of fueling sites, requirements for spill containment, and other measures to safeguard aquatic and terrestrial habitat from construction-related contaminants in contracts.
- Locating fuel storage tanks outside of the floodplain / channel migration zone floodplains and other sensitive areas.

Photo 34 – A community gathering in Stehekin.

## Cumulative Impacts

Hazardous materials have the potential to contaminate soil or groundwater or expose workers to certain health hazards. Past, present, and future activities in the project area, such as storage, use, or generation of hazardous materials and hazardous wastes, could have produced soil contamination. This is particularly true in Alternatives 1 - 5 in the maintenance area and in Alternatives 2 and 5 at the shooting range. There may also be areas where the fill and underlying groundwater require additional assessment and characterization for potential sources of environmental contamination. These sources would include contamination to soil or groundwater that could expose construction workers and others to certain health hazards. Unknown locations of underground storage tanks may also be present in the project vicinity. Residual contamination in the project area could pose health threats to workers or future users of the property, and could pose constraints to development. There would be no additional long-term contribution to cumulative effects from Alternatives 1 - 4. Contributions would be long-term and beneficial from removal of potential areas of hazardous materials in the former maintenance area (Alternatives 1 - 5) and at the shooting range (Alternatives 2 and 5).

## Conclusion

Alternatives 1 - 5 have the potential to release hazardous materials from construction and removal of facilities from the floodplain. There would be negligible to moderate localized short-term adverse impacts from these activities. Hazardous materials may be present in proposed buildings and structures deconstructed or removed in the maintenance area and within the floodplain and other materials used in the proposed projects. Over the long term, removal of hazardous materials from the floodplain in all alternatives would have a substantial long-term beneficial effect.

# 24. Unavoidable Adverse Impacts

Unavoidable adverse impacts are defined as moderate to major impacts that cannot be fully mitigated or avoided.

## Impacts from Actions Common to All Alternatives

The presence of development in the lower Stehekin Valley floodplain is an ongoing cumulative unavoidable major adverse impact. Under Alternative 1, conditions associated with this development in the floodplain of the Stehekin River would improve, primarily associated with NPS administrative structures and with the removal of the maintenance area from the floodplain. Nonetheless, private development and portions of the Stehekin Valley Road and Company Creek Roads would continue to remain within the floodplain / channel migration zone. Although private lands would continue to be exchanged and or purchased and some of these acquisitions or exchanges would remove development from the floodplain / channel migration zone of the Stehekin River, it is likely that some development could continue to remain within the floodplain / channel migration zone. Aside from the development in the floodplain, private development is fully consistent with the intent of the Lake Chelan NRA legislation, with the Stehekin Community providing valuable services for visitors to Lake Chelan NRA.

### *Alternative 1*

Ongoing moderate to major adverse impacts associated with the location of the Stehekin Valley Road in the floodplain / channel migration zone of the Stehekin River would remain under Alternative 1. In addition, there would be some additional filling of the floodplain from raising the height of a portion of the Stehekin Valley Road through McGregor Meadows. Other unavoidable moderate adverse impacts would continue to result from the location of existing erosion protection measures, including both riverbank and instream structures currently affecting approximately 6.5 percent of the Stehekin River bank. Implementation of Alternative 1 would increase this to 6.82 percent.

### *Alternatives 2, 3 and 5*

Moderate to major adverse effects on the floodplain / channel migration zone of the Stehekin River associated with the cumulative effects of development in the lower Stehekin Valley as described under Alternative 1 would continue. Under Alternatives 2, 3 and 5, there would be some additional potential for removal of private development from the floodplain / channel migration zone from the revised 2010 or 2012 LPP priorities; however, it is likely that some development would remain since exchanges and acquisitions would continue to be on a voluntary basis, based on the desire of private landowners to remove their existing homes from the future threat of flooding in the floodplain / channel migration zone. In addition, the NPS does not have enough suitable land for exchange to remove all private development from the 100-year floodplain by this process.

Ongoing moderate adverse impacts associated with the location of the Stehekin Valley Road in the floodplain / channel migration zone would also continue under Alternatives 2, 3 and 5, albeit to a lesser extent than in Alternative 1 and 4 because portions of the road (different) would be rerouted. In Alternative 3, more of the road (including the area adjacent to the Lower Field) would also remain close to the river. Erosion protection measures in Alternatives 2 and 5 would affect an additional 1.22 percent of the Stehekin River bank, while in Alternative 3 they would affect an additional 1.6 percent.

### *Alternative 4*

Major adverse effects associated with development in Alternative 1 would also occur in Alternative 4. Similarly, Alternative 4, like Alternatives 2, 3 and 5, would offer some potential for improvement by enabling private development to be relocated from the floodplain based on new LPP priorities, however, in Alternative 4, the LPP priorities would be affected by retention of the Stehekin Valley Road in its current alignment and using erosion protection measures along the Stehekin River. Compared to Alternative 1, these would affect an additional 2.7 percent of the Stehekin River bank. It is likely that fewer private properties within the floodplain / channel migration zone would be exchanged under this alternative.

## Conclusion

Alternatives 1 - 5 would continue to have moderate to major adverse impacts from development remaining within the floodplain / channel migration zone, including private homes, roads and the Company Creek levee. Alternatives 2, 3, and 5 would improve conditions by removing a portion of the Stehekin Valley Road from the floodplain / channel migration zone and Alternatives 2 - 5 would also allow relocation of private development from the floodplain / channel migration zone through a revised emphasis in the LPP. Ongoing minor to moderate adverse effects would continue from existing (Alternatives 1 - 5) and new (Alternatives 2 - 5) erosion protection measures along the banks of the Stehekin River.

## 25. Relationship between Short-term Use of the Environment and Maintenance and Enhancement of Long-term Productivity

### Impacts from Actions Common to Alternatives 1 and 4

Major development actions in Alternatives 1 and 4 consist of modifications to the Stehekin Valley Road and construction of a replacement maintenance area and new housing area. Although impacts from road modifications would affect some additional undeveloped areas to construct the winter turnaround and pullouts, would have negligible impacts on long-term productivity within the lower Stehekin Valley. Most lands within Lake Chelan NRA would remain open and unaltered as a result of the proposed projects. Even development of the replacement maintenance and housing area would have overall minor effects since these impacts would occur in an area that has already lost much of its former productivity by being converted to now unused golf course fairways, where the area was graded and its native vegetation removed, and maintained as an open area. Although the area is now in recovery, its long-term productivity would not be improved without active restoration. Because the former maintenance area would be restored in combination with the development of the replacement maintenance area and because the existing maintenance area is located within a more productive habitat (floodplain area), there would be long-term beneficial effects on long-term productivity from the removal of the maintenance area from its current location and its replacement in another, less sensitive, environment.

### Impacts from Actions Common to Alternatives 2, 3 and 5

In addition to the major development actions identified above as part of Alternatives 1 and 4, major development actions in Alternatives 2, 3 and 5 include the construction of the road reroutes, although these vary. Development of the road reroutes would have direct effects on another 18 acres and indirect effects on up to 23 acres of now forested upland in Alternatives 2, 3 and 5 but would allow the restoration of riparian area now covered by road surface, a long-term beneficial effect on productivity since this habitat is located close to the river and has a naturally higher level of productivity than upland forest habitat, which is far more abundant in Lake Chelan NRA. Although the development effects would be removed from these more sensitive riparian habitats, it would not compensate for the loss of additional intact forested habitat. As a result, this use of forested habitat would result in negligible to minor long-term diminished productivity in the affected area over time, but would increase due to beneficial impacts from edge effects introducing an increased diversity of species into the area. In addition, there would be additional restoration of six acres of degraded riparian area at the former maintenance area, Buckner Homestead hayfield and pasture, the Lower Field, and other areas in these alternatives, as well as in Alternative 4.

## Conclusion

New development would affect about eight acres in Alternative 1, 22 acres in Alternative 2, 23 acres in Alternative 3, ten acres in Alternative 4, and 24 acres in Alternative 5. In addition, some portion of the 37 acres of available exchange lands in Alternative 1 and some portion of the 24 acres of available exchange lands in Alternatives 2 - 4 and 29 acres in Alternative 5 could be developed. Most of this land has been affected by human activities or is forested (reroutes). Restoration of more productive riparian areas would compensate for some of this loss, accounting for about 5.0 acres in Alternative 1, 7.88 acres in Alternatives 2 and 5, 7.42 acres in Alternative 3, and 6.42 acres in Alternative 4.

# 26. Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are actions that result in the loss of resources that cannot be reversed. Irretrievable commitments are actions that result in the loss of resources but only for a limited time.

## Impacts from Actions Common to Alternatives 1 - 5

While development effects would be long-term, effects from development are to some degree reversible and could, if desired, be removed, and the areas returned to natural landscape. It is likely that effects, however, would remain visible on the landscape for decades. Old roads and trails that have been left are often still visible for more than 50 years. If active restoration, however, is conducted and contours are restored, it is possible to diminish the effects of development; however, when this occurs in a forest of old trees, then the effects remain visible as a younger band of trees for decades.

Actions taken that would “use up” resources in a way that could not be reversed, include the removal of mature trees from the forested landscape (for road rehabilitation actions in Alternatives 1 - 5 and for the reroutes in Alternatives 2, 3 and 5) and for building materials procured elsewhere. Fill materials would not be balanced in Alternative 4 and actions would therefore require the importation of approximately 5,600 cubic yards of fill for the road grade raise. Fill materials would be balanced in Alternatives 2, 3 and 5, but because of this would disturb a larger area for the reroutes. Depending on the source of materials procured for Alternatives 1 and 4, impacts from their procurement could be considered irreversible since the materials would be taken from one area and moved to another area. Additionally, materials use for all the alternatives for building construction and outfitting would also result in the loss of materials from one area and their movement to another. To the degree that nonrenewable resources, including minerals and metals, were used, such use would preclude other uses and would be an irreversible commitment of resources.

## Conclusion

Because development of the road and new facilities area currently affect only a very small percentage of the lower Stehekin Valley (see “Land Use Impacts” in this chapter), are small in comparison to development occurring outside the area, and would not undergo major changes as a result of the implementation of Alternatives 1 - 5, irreversible and irretrievable commitments would be minor in all alternatives.

## Table IV-16: Impact Comparison Chart

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Land Use** | | | | |
| **Actions Common to All Alternatives** | Relocating maintenance and housing: Long-term localized moderate adverse effects on 5 - 8 acres near the airstrip and major beneficial effects from restoration of riparian and upland areas (5 acres) and creation of more sustainable land use patterns outside CMZ.<br>Winter Turnaround, pullouts, and erosion protection at Wilson Creek: Minor adverse effects. | | | |
| **Actions Differing Between Alternatives** | New development on ten acres.<br>Road rehabilitation: Long-term minor adverse effects from improvements to existing road.<br>LPP: Long-term minor to major adverse and moderate beneficial effects from potential exchange of 37 acres.<br>Erosion protection: Long-term minor adverse effects.<br>Restoration: Additional negligible beneficial effects. | Alternative 2<br>New development on 23 acres.<br>Road rehabilitation: Same as Alternative 1 with fewer impacts from less road rehabilitated.<br>Reroute construction: Long-term major adverse effects from development of 13 acres from 1.9 mile reroute.<br>LPP: Long-term minor to moderate adverse and major beneficial effects from potential exchange of 24 acres.<br>Erosion protection: Long-term minor to moderate localized from 6 - 8 barbs and two logjams.<br><br>Alternative 5<br>Same as Alternative 2 except:<br>New development would occur on 1.0 - 1.2 acres for the Reroute Access Connector.<br>LPP: Long-term minor to moderate adverse and major beneficial effects from potential exchange of 29 acres. Potentially fewer beneficial effects than in Alternative 2. | New development on 23 acres.<br>Impacts similar to Alternative 2 with fewer adverse impacts from shorter reroute and more from more erosion protection measures (six sites, four barbs and six logjams). | New development on 11 acres.<br>Road rehabilitation: Impacts same as Alternative 1.<br>LPP: Impacts similar to Alternatives 2, 3 and 5 with less land exchanged from channel migration zone (moderate to major beneficial).<br>Erosion protection: Similar to Alternatives 2, 3 and 5 with more minor to moderate adverse impacts from many more erosion protection measures (eight sites, 16 - 17 barbs and three logjams).<br>Restoration: Similar to Alternative 2. |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| **Cumulative Impacts** | Alternatives 1 and 4 would contribute the fewest changes in land use (locally minor to moderate adverse effects on land use) since they would result in the least amount of additional development, however they would continue to have the potential to have the greatest impact on sustainability of road access and land use in the channel migration zone. The road reroutes in Alternatives 2, 3 and 5 would contribute greater cumulative effects on development (minor to major adverse effects) from the relocation of the road from adjacent to the river to a currently forested area and the fewest impacts on the movement of the river channel. | | | |
| **Conclusion** | The greatest direct effects on land use would occur in Alternatives 2, 3 and 5 because they would relocate the road (with its existing adverse changes in the channel migration zone) to higher ground and disturb new areas (approximately 13 acres). At the same time, relocating the road would have long-term beneficial impacts on the sustainability of the Stehekin Valley Road and would provide for restoration of the portion of the road currently in the floodplain / channel migration zone. Because Alternatives 1 and 4 would retain the road (including these adverse effects in the channel migration zone) there would be fewer impacts on undisturbed lands (approximately 10 and 11 acres, respectively); however, Alternatives 1 and 4 would continue to result in a continuation of unsustainable land use and affect the channel migration zone by leaving more of the road within it. Compared to the area that would be retained and pr.80otected within the lower Stehekin Valley, depending on the alternative selected, new development would occur on a very small percentage of the land within Lake Chelan NRA.<br>Because nearly all of Lake Chelan NRA would be retained in public ownership, reroute impacts in Alternatives 2, 3 and 5 would occur in a common forest community type, and the Stehekin Community would remain, there would be no significant adverse effects on land use as a result of the implementation of Alternatives 1 - 5. | | | |
| **Air Quality** | | | | |
| **Actions Common to All Alterna-tives** | Localized short-term negligible to moderate adverse effects from soil moving activities, surfacing, transport of materials, evaporative emissions, and traffic delays associated with construction of housing and maintenance areas, road rehabilitation and construction of the Lower Valley Trail. Localized, long-term beneficial effects from surfacing (reducing dust), energy efficient design, LEED certification, and restoration of former maintenance area. | | | |
| **Actions Differing Between Alterna-tives** | Road grade raise / erosion protection: Additional minor to moderate short-term localized adverse impacts from transport of fill for McGregor Meadows and rip-rap / log-cribbing for Wilson Creek. | Alternative 2<br>Road reroute: Additional short-term minor to moderate impacts from forest clearing, cuts and fills, and construction of road reroute.<br>Erosion protection / recreational facilities: Additional localized short-term negligible to minor adverse effects from construction.<br>Restoration: Additional long-term negligible beneficial effects from more restoration.<br>Alternative 5<br>Same as Alternative 2 | Similar additional negligible to moderate impacts related to the same actions in Alternative 2, with fewer construction impacts from recreational facilities and more from erosion protection measures.<br>Restoration: Fewer negligible beneficial effects than Alternative 2 from less restoration. | Road grade raise: Same as Alternative 1<br>Erosion protection / recreational facilities: Additional short-term minor to adverse impacts from more construction.<br>Restoration: Similar to Alternative 3 with less road restoration. |
| **Cumulative Impacts** | There would be no long-term contributions to particulate or other emissions from Alternatives 1 - 5. NAAQS would be expected to remain within existing standards. Alternatives 1 - 5 would contribute short-term negligible to minor cumulative impacts from particulate, exhaust, and evaporative emissions during construction and long-term beneficial effects from energy efficient building use and surfacing. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| **Conclusion** | Alternatives 1 - 5 would have mostly localized, short-term, negligible to moderate adverse impacts lasting only during construction activities.<br>Alternative 1 would have additional impacts from the grade raise. Alternatives 2, 3 and 5 would have additional particulate and exhaust emissions due to greater excavation for the reroutes. Alternative 4 would also have additional emissions from more importation of rock for barbs and soil for the grade raise. Beneficial impacts from restoration and bioengineering would be greatest in Alternatives 2 and 5, followed by Alternatives 3, 4, and 1. All alternatives would have long-term localized beneficial effects from reducing gravel use from the Company Creek Pit and from dust reduction on the main road, though the Company Creek Road (Alternatives 1-5) and the McGregor Meadows Access Road (Alternatives 2, 3 and 5) would continue to be unpaved.<br>There would be no major adverse impacts to air quality or air quality-related values from the proposed actions under the alternatives. | | | |
| **Soils and Vegetation** | | | | |
| **Actions Common to All Alterna-tives** | Impacts from Actions Common to All Alternatives: Long-term minor to major adverse effects from construction of the maintenance and housing area and localized beneficial effects from upland and riparian restoration of the former maintenance area. Short-term negligible to moderate adverse effects from ongoing road maintenance and from rehabilitation, including construction of winter turnaround and pullouts. Minor to moderate short- and long-term adverse effects from road realignment at Wilson Creek (including construction and maintenance of an access road), relocation of campsites and docks at Weaver Point, and minor to moderate adverse effects from construction of the Lower Valley Trail. Additional beneficial effects from dust reduction and vegetation restoration following disturbance. | | | |
| **Actions Differing Between Alterna-tives** *(continued on next page* | Road grade raise: Additional short- and long-term negligible to minor adverse effects.<br>Road realignment: Additional minor adverse and beneficial effects.<br>Erosion protection: Additional minor adverse impacts on soils from rip-rap and log cribbing at Wilson Creek.<br>Large woody debris: No effects.<br>LPP: Long-term minor to moderate adverse and beneficial effects from ongoing implementation. | Alternative 2<br>Road reroute: Short- and long-term moderate adverse impacts on soils and moderate to short-term major adverse impacts on vegetation from construction. Loss of approximately 238 trees per acre in 13 acres. Negligible to moderate beneficial effects from revegetation.<br>Access road / recreation: Long-term minor adverse effects from ongoing maintenance of 1.0 - 1.2 miles of road in floodplain / channel migration zone and construction of recreation facilities.<br>Erosion protection: Short- and long-term minor to moderate localized adverse effects from construction and negligible to minor beneficial effects from bioengineering.<br>Milepost 8.0 / 9.2: Localized minor adverse and minor beneficial effects.<br>Large woody debris: Short-term minor adverse and long-term minor beneficial effects. | Impacts same as Alternative 2 from access road, Milepost 8.0, 9.2, large woody debris, and LPP.<br>Road reroute: Similar to Alternative 2, with fewer adverse effects from shorter reroute.<br>Recreation: Similar to Alternative 2, with impacts from one more camp, no river access point and retention of shooting range.<br>Erosion protection: Similar to Alternative 2, with fewer barbs and more logjams in two more sites.<br>Restoration: Similar to Alternative 2, with less road restoration and more bioengineering results in moderate benefit.<br>LPP: Same as Alternative 2. | Additional short- and long-term minor adverse impacts for road grade raise / realignment and same as Alternatives 2, 3 and 5 for Mileposts 8.0 and 9.2 actions.<br>Recreation: Similar to Alternative 2, but with negligible impacts from one more camp and retention of shooting range.<br>Erosion protection: Similar to Alternative 3 but with additional minor to moderate adverse and negligible beneficial effects from more barbs in more locations.<br>Restoration: Similar to Alternative 3, but with no road restoration.<br>Large woody debris: Additional minor adverse and beneficial impacts from larger procurement area.<br>LPP: Similar to Alternatives 2, 3 and 5, but with less exchange targeted in channel migration zone results in moderate beneficial impact. |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| *(continued from previous page)* | | Restoration: Long-term minor to major beneficial effects from restoration of Buckner, Lower Field, old road, other erosion protection areas, and bioengineering.<br>LPP: Long-term minor to moderate adverse effects from development of 10 - 15 exchanged parcels and long-term moderate to major beneficial effects from acquisition or exchange in riparian areas.<br>Alternative 5<br>Same as Alternative 2 except:<br>There would be additional effects on soils and vegetation from development of the Reroute Access Connector and from construction of a concrete box culvert, rather than a low water crossing at Milepost 8.5.The Connector would affect approximately 1.0 - 1.2 acres of soils and vegetation and the box culvert would include additional fill within the road corridor leading up to it and excavation for the culvert and an outlet channel. | | |
| **Cumulative Impacts** | Alternative 1 would contribute localized negligible to moderate adverse effects and localized minor to moderate beneficial effects. Alternatives 2, 3 and 5 would contribute localized negligible to moderate adverse impacts and localized minor to moderate beneficial effects. Alternative 4 would contribute localized minor to moderate adverse effects and minor to moderate beneficial effects. | | | |
| **Conclusion** | Alternative 1 would have negligible to moderate adverse and negligible to major beneficial effects. Alternatives 2 and 5 would have negligible to major adverse and beneficial effects. Alternative 3 would have impacts similar to Alternative 2, with adverse and beneficial effects both somewhat less from shorter reroute, less restoration, and more erosion protection measures. Alternative 4 would contribute negligible to moderate adverse effects and minor to major beneficial effects. There would be slightly more adverse effects under Alternative 5, compared to Alternative 2, primarily from construction of the Reroute Access Connector. | | | |
| **Geologic Hazards** | | | | |
| **Actions Common to All Alterna-tives** | Ongoing long-term minor to moderate potential for injury or damage from geologic hazards. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| **Actions Differing Between Alterna-tives** | 1 - 5 Ongoing long-term minor to moderate exposure to flood hazards on the Stehekin Valley and Company Creek roads. | Alternatives 2 and 5<br>Reduced impacts from rock fall hazard at Milepost 8.0 (minor beneficial) and with most flood hazards on the Stehekin Valley Road (moderate beneficial). The potential for injury or damage would remain minor to moderate. Minor new risks would be associated with relocated recreational facilities and minor to moderate from the debris flow or snow avalanche hazards on the reroute. | | Same as Alternative 1 except reduction of hazards at Milepost 8.0 and minor additional hazards from recreational facilities as in Alternatives 2, 3 and 5. |
| **Cumulative Impacts** | A variety of potential hazards would continue to exist. The contribution of additional impacts from Alternatives 1 - 5 would be negligible to minor. | | | |
| **Conclusion** | Alternatives 1 - 5 would have a minor increase in exposure to geologic hazards. Alternatives 2, 3 and 5 would reduce roadway flood hazards along reroute sections. Alternatives 2 - 5 would have long-term beneficial impacts from stabilizing the slope at Milepost 8.0. | | | |
| **Water Resources: Hydraulics and Streamflow** | | | | |
| **Actions Common to All Alterna-tives** | Ongoing long-term minor to major adverse effects from maintaining the Company Creek Road and levee. Major adverse impacts would occur from retaining the Stehekin Valley Road (Alternatives 1 and 4) or moderate impacts from retention of the McGregor Meadows Access Road (Alternatives 2, 3 and 5). Minor to moderate adverse effects from road rehabilitation actions coupled with minor long-term beneficial effects from surfacing from less erosion of fill. Long-term minor adverse and beneficial effects from drainage modifications. Long-term moderate beneficial effects from maintenance facility and housing replacement and relocation. Long-term negligible to moderate adverse effects from construction of Lower Valley Trail. Long-term negligible to moderate beneficial effects from removal of structures and from restoration and bioengineering. | | | |
| **Actions Differing Between Alterna-tives** *(continued on next page)* | Road grade raise: Long-term localized moderate to major adverse effect on floodwater level and flow.<br>Erosion protection: Long-term moderate adverse effects from rip-rap and log-cribbing at Wilson Creek.<br>LPP: Ongoing long-term minor to moderate, occasionally moderate to major, adverse impacts from development in floodplain / channel migration zone. Ongoing minor beneficial effects from effort to remove development from floodplain. | Alternative 2<br>Road reroute: Long-term moderate to major beneficial effects from allowing floodwater, wood, and gravel storage and lateral migration of channel.<br>Access road: Minor short-term adverse impacts from potential release of road sediments and on floodwater elevation and flow.<br>Milepost 8.0: Short-term minor adverse and long-term moderate beneficial effects from slope stabilization.<br>Erosion protection: Minor adverse impacts from new structures on the edge of the channel migration zone and moderate impacts from those within it. Minor to moderate beneficial effects from restoring more natural rates of erosion. Minor to moderate increase in hardening | Road reroute: Long-term moderate adverse impacts from retention of some of the road in the channel migration zone. Moderate beneficial effects.<br>Erosion protection: Similar to Alternative 2, but with additional localized minor to moderate adverse impacts from two more sites with actions (1.7% more of riverbank).<br>Localized moderate to major adverse impact in Reach 1, minor to moderate in Reaches 2 and 3, and moderate in Reach 4.<br>Access road / Milepost 8.0 / Restoration / LPP: Same as Alternative 2 with slightly less road restoration. | Road grade raise: Long-term localized moderate to major adverse effect on floodwater level and flow.<br>Erosion protection: Same as Alternative3 plus actions at two more sites, a moderate to major adverse impact.<br>Localized long-term major impact in Reach 1, minor to moderate in Reaches 2 and 3 (same as Alternative 2), and moderate in Reach 4 and an undesignated reach near Milepost 9.2.<br>LPP: Same long-term major impact as in Alternative 1 plus minor long-term beneficial impacts. |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| *(continued from previous page)* | | of additional 1.4% more of riverbank.<br>Localized long-term moderate adverse impacts in Reach 1, minor to moderate in Reach 2 and Reach 3 from increased area of hardened riverbank.<br>Restoration and bioengineering: Long-term localized beneficial effect from increase in stream bank cover.<br>LPP: Same as Alternative 1 plus long-term beneficial impacts.<br>Alternative 5<br>Same as Alternative 2 plus:<br>Reroute Access Connector: Long-term minor to major adverse effects from construction in a wetland within the floodplain / channel migration zone. | | |
| **Cumulative Impacts** | All alternatives would contribute minor to moderate cumulative impacts from increasing the amount of hardened streambank. Measures in Alternative 4 would add the most to cumulative effects, while Alternative 1 would likely equal these over time. Alternative 2 would have the fewest additions to cumulative adverse effects. All alternatives would also contribute long-term minor beneficial effects from relocating the housing and maintenance areas. | | | |
| **Conclusion** | Alternative 2 would have the fewest effects, followed by Alternatives 5, 3, 4, and 1. Alternative 1 would have long-term minor to major adverse effects and beneficial effects. Alternative 2 would have long-term minor to moderate adverse effects and long-term minor to major beneficial effects. Alternatives 3 and 5 would have long-term minor to moderate and localized major adverse effects and long-term minor to major beneficial effects. Alternative 4 would have minor to major adverse effects and minor to major beneficial effects. | | | |
| **Water Resources: Water Quality** | | | | |
| **Actions Common to All Alternatives** | Localized negligible to moderate long-term adverse effects from existing development and operations. Short-term negligible to minor adverse effects from runoff and long-term minor to moderate beneficial effects from surfacing. Short-term localized negligible to minor adverse effects from culvert work and Lower Valley Trail. Short-term minor to moderate localized adverse impacts from construction. Minor to moderate adverse impacts from removal of structures coupled with long-term moderate to major beneficial effects. Moderate to major beneficial effects from replacement and relocation of maintenance area. | | | |
| **Actions Differing Between Alternatives** *(continued on next page)* | Road grade raise: Short-term moderate to major localized adverse impacts from potential release of fill.<br>Erosion protection: Short-term minor adverse and long-term beneficial effects at Wilson Creek. | Alternative 2<br>Road reroute: Short- and long-term minor impacts from runoff.<br>Erosion protection: Short-term minor to moderate localized adverse impacts from placement of barbs and logjams and long-term | Road reroute: Similar to Alternative 2 with short-term minor adverse impacts.<br>Erosion protection: Similar to Alternative 2 with additional impacts from a different array of structures. | Road grade raise: Same as Alternative 1.<br>Erosion protection: Similar to Alternative 2 with more structures at more sites.<br>Large woody debris: Additional short-term minor impacts from |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| *(continued from previous page)* | Large woody debris: No effects.<br>LPP: Short-term negligible to moderate adverse and long-term minor to moderate beneficial effects. | negligible to moderate beneficial impacts from reducing erosion.<br>Milepost 8.0 and 9.2: Minor to moderate beneficial impacts from slope retention / decreasing erosion.<br>Large woody debris: Short-term negligible to minor adverse effects from access.<br>Recreation: Short-term negligible to minor adverse effects from construction. Potential beneficial impacts from restoration of shooting range.<br>LPP: Potential long-term moderate to major beneficial and short-term minor to major adverse effects.<br>Alternative 5<br>Reroute Access Connector: If future flooding affected this short section of unpaved road, there would be short-term minor to moderate adverse impacts on water quality. | Milepost 8.0 / 9.2 / Large Woody Debris / LPP: Same as Alternative 2. | additional procurement area.<br>LPP: Long-term minor to major beneficial impacts from removal of structures combined with potential short-term adverse similar to Alternatives 2, 3 and 5. |
| **Cumulative Impacts** | Alternatives 1 - 5 would contribute minor localized cumulative adverse impacts from construction of new maintenance and housing, negligible to minor long-term beneficial effects from road rehabilitation, and minor to moderate adverse and beneficial effects from LPP actions. Alternatives 2, 3 and 5 would contribute additional minor adverse and long-term beneficial effects from the reroutes and Alternatives 2 - 5 would contribute additional moderate beneficial effects from LPP actions. | | | |
| **Conclusion** | Alternative 1 would have short-term negligible to major localized adverse effects and long-term minor to moderate beneficial effects. Alternatives 2- 5 would have short-term minor to major localized adverse effects and long-term minor to major beneficial effects. | | | |
| **Water Resources: Wetlands** | | | | |
| **Actions Common to All Alterna-tives** | Short-term negligible to minor adverse effects on wetlands from construction and negligible to moderate or major beneficial impacts from restoration. There would be short-term minor adverse effects from replacement of intermittent and perennial stream culverts and long-term negligible to minor effects from maintaining these and snowmelt drainage culverts. Long-term beneficial effects from restoration of 1.5 acres of palustrine forested wetlands in the current maintenance area. Ongoing beneficial impacts from acquisition of lands within the floodplain. | | | |
| **Actions Differing Between Alterna-tives** *(continued on next page)* | Road grade raise: Long-term localized moderate adverse impacts from elevated road. | Alternative 2<br>Road reroute: Long-term minor to moderate beneficial effects from removing road from floodplain / channel migration zone.<br>Erosion protection: Short-term minor to moderate adverse effects | Road reroute / Large woody debris: Same as Alternative 2.<br>Erosion protection: Similar to Alternative 2 with additional minor and moderate adverse effects from additional measures within and adjacent to channel migration zone | Road grade raise: Same as Alternative 1.<br>LPP: Additional minor to moderate beneficial impacts from opportunities to acquire lands within channel migration zone.<br>Erosion protection: Impacts similar |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| *(continued from previous page)* | | from construction of barbs and logjams, particularly from actions within or adjacent to water coupled with long-term beneficial effects from revegetation and riparian restoration.<br>Large woody debris: Negligible to minor short-term adverse effects from access for procurement.<br>Restoration: Long-term beneficial effects from restoration of Buckner and Lower Field riparian areas and from other restoration associated with erosion protection measures.<br>LPP: Long-term minor to moderate beneficial effects from acquisition of riparian areas or exchange of uplands for riparian areas.<br>Alternative 5<br>Reroute Access Connector: The connector would affect 0.1 acres of wetlands, a long-term minor to moderate localized adverse effect | (minor to moderate adverse).<br>Restoration: Similar to Alternative 2, with less restoration of riparian area in old road alignment (moderate beneficial) and ongoing impacts from continued location of road next to Lower Field riparian area (moderate adverse). | to Alternatives 2, 3 and 5, but with more moderate adverse effects from more structures within and on the edge of the river.<br>Restoration: Similar to Alternatives 2, 3 and 5, but without road restoration in McGregor Meadows and Lower Field. |
| **Cumulative Impacts** | All alternatives would contribute long-term moderate beneficial effects from restoration of the maintenance area and long-term minor adverse and negligible to minor beneficial effects from erosion protection measures and replacement / construction of culverts. Alternatives 2, 3 and 5 would have similar beneficial and adverse contributions, with more adverse and fewer beneficial effects in Alternative 3 because of ongoing impacts adjacent to Lower Field. Alternatives 2 - 5 would contribute slightly more beneficial effects from restoration than Alternative 1. | | | |
| **Conclusion** | There would be short- and long-term adverse effects from impacts to wetlands of less than one acre in Alternatives 1 - 3 and 5. Alternative 1 would affect 0.43 acres of wetlands; Alternative 2 would affect 0.5 acres; Alternative 3 would affect 0.6 acres; Alternative 4 would affect 1.4 acres and Alternative 5 would affect 0.64 acres. Long-term beneficial impacts would occur from approximately 1.5 acres of restoration in Alternative 1, 4.1 acres in Alternatives 2 and 5, 3.9 in Alternative 3, and 2.9 in Alternative. Jurisdictional wetland impacts would include erosion protection measures (barbs and logjams above) plus impacts from culvert modifications and impacts associated with the Reroute Access Connector in Alternative 5. | | | |
| **Water Resources: Floodplains** | | | | |
| **Actions Common to All Alterna-tives** | Ongoing moderate to major adverse impacts from retaining Stehekin Valley Road floodplain channel migration zone in McGregor Meadows and from the Bakery to Lake Chelan and from Company Creek Road near Harlequin Bridge and above Company Creek. Ongoing negligible to minor adverse effects from maintaining recreational facilities in floodplains. Long-term minor to moderate adverse effects from not retaining the Stehekin Valley Road in its current alignment near Milepost 3.8 (Frog Island), Milepost 5.3 (Wilson Creek), Milepost 8.0 and 8.5. Long-term moderate to major beneficial effects from relocating housing and maintenance areas (including fuel storage area) outside of regulatory floodplains. Long-term minor to moderate beneficial effects from allowing floods to overtop riverbanks. Long-term minor to moderate adverse impacts from existing erosion protection measures. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| **Actions Differing Between Alterna-tives** | Road grade raise: Localized moderate to major adverse impacts from placement of 5,600 cubic yards fill. | Alternative 2<br>Road reroute: Long-term moderate to major beneficial effects from restoring floodplain values and functions.<br>Access road: Long-term localized minor to moderate adverse impacts.<br>Erosion protection: Minor to moderate adverse impacts from three structures on the edge of the channel migration zone and one within it.<br>Restoration and bioengineering: Long-term minor beneficial effects from slowed bank erosion.<br>LPP: Potential for long-term moderate to major beneficial effects by removal of private development.<br>Alternative 5<br>Reroute Access Connector: The connector would affect 0.1 acres of wetlands, a long-term minor to moderate localized adverse effect | Access road / Restoration and bioengineering / Removal of structures / LPP: Same as Alternative 2.<br>Reroute: Long-term minor to moderate beneficial impacts and ongoing minor to moderate adverse effects from 1.2 acres remaining within channel migration zone.<br>Erosion protection: Similar to Alternative 2 with additional long-term minor to moderate adverse effects from more structures within or on the edge of the channel migration zone. | Road grade raise: Same as Alternative 1.<br>Restoration and bioengineering: Same as Alternative 2.<br>Erosion protection: Similar to Alternative 3, with additional long-term minor to major adverse impacts from more structures within channel migration zone.<br>LPP: Potential long-term minor to moderate beneficial effects on floodplains. |
| **Cumulative Impacts** | Alternatives 1 and 4 would contribute moderate adverse impacts from fill used for the road grade raise. Alternatives 2, 3 and 5 would contribute minor effects from retaining the Access Road in the floodplain. Alternative 5 would contribute additional adverse effects from construction of the Reroute Access Connector in the floodplain. Long-term negligible benefits would be contributed in all but Alternative 1 from the changed priorities for land acquisition and exchange, though these would be greater in Alternatives 2, 3 and 5 from prioritizing lands primarily to remove development from not just the floodplain, but also the channel migration zone. All action alternatives would move toward less development within the floodplain, a long-term beneficial effect, depending on the alternative. | | | |
| **Conclusion** | The combined effects of the actions in Alternative 1 would result in a series of localized, long-term negligible to major adverse effects coupled with some long-term moderate to major beneficial effects. Alternative 2 would result in similar negligible to moderate adverse effects, while it would have more long-term moderate to major beneficial effects. Alternative 3 would have effects similar to Alternative 2, including a range of negligible to moderate adverse and beneficial impacts from many of the same actions. These would include fewer beneficial effects from a shorter reroute and from the implementation of additional erosion protection measures in areas where the road is within the floodplain / channel migration zone. Alternative 4 would essentially combine the effects of retaining the Stehekin Valley Road in its current alignment as in Alternative 1, a long-term moderate to major adverse effect, with the erosion protection and restoration measures in Alternatives 2, 3 and 5, resulting in some long-term negligible to moderate beneficial effects. Alternative 5 would have effects similar to Alternative 2 with negligible to moderate adverse effects and moderate to major beneficial effects, with more moderate adverse effects from construction of 400 feet of the Reroute Access Connector in the floodplain. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| Fish and Wildlife | | | | |
| **Actions Common to All Alterna-tives** | Short-term localized negligible to minor disturbance from noise and construction activity and long-term minor to moderate disturbance from new developed areas. Ongoing negligible to minor impacts from vehicle-wildlife collisions. Long-term minor to moderate habitat loss from road rehabilitation and facility construction. Potential minor short-term impacts from sedimentation attributed to earth moving activities and localized minor adverse effects from work at Wilson Creek. Minor adverse effects from contamination from runoff after surfacing. Long-term negligible to moderate localized beneficial impacts from habitat restoration. Short- and long-term negligible to moderate localized impacts from other construction activities. Localized short-term minor to moderate adverse impacts from construction of the Lower Valley Trail. Long-term moderate beneficial impacts from habitat restoration of former maintenance area. | | | |
| **Actions Differing Between Alterna-tives** *(continued on next page)* | Road grade raise / realignment: Negligible to moderate adverse effects from reduction in habitat and potential for sedimentation due grade raise / realignment.<br>Erosion protection: Long-term localized moderate impacts to aquatic habitat from rip-rap and log-cribbing at Wilson Creek.<br>Large woody debris: Ongoing negligible to minor adverse impacts on fish and aquatic species.<br>LPP: Ongoing long-term negligible to moderate beneficial and minor to moderate adverse effects. | Alternative 2<br>Road reroute: Short-to long-term localized moderate to major adverse effects from habitat loss. Negligible to minor beneficial effects from edge habitat creation and restoration over time of cuts and fills.<br>Erosion protection: Short-term minor to moderate adverse and long-term minor to moderate beneficial effects on bank stabilization and habitat loss and creation.<br>Milepost 8.0, 8.5 and 9.2: Negligible to minor adverse impacts from habitat modification and disturbance and long-term minor beneficial effects from revegetation and stabilization.<br>Large woody debris: Short-term minor adverse impacts during procurement and long-term minor beneficial impacts from use of wood over rock.<br>Recreation: Short- and long-term negligible to moderate adverse effects from construction and use and long-term negligible to minor effects from habitat modification.<br>Restoration: Long-term beneficial impacts from restoration.<br>LPP: Long-term minor to moderate | Road reroute: Same as Alternative 2 except for shorter distance with fewer impacts.<br>Erosion protection: Similar to Alternative 2 with more adverse and more beneficial impacts.<br>Restoration: Same as Alternative 2 except with less road restoration from shorter reroute.<br>LPP: Same as Alternative 2.<br>Recreation: Fewer adverse impacts from no river access point and one additional camp. | Road grade raise: Same as Alternative 1.<br>Erosion protection: Similar to Alternative 3 with short-term minor to moderate adverse and negligible to minor beneficial impacts.<br>Large woody debris: Negligible to minor adverse effects, including potential for more dispersed impacts from wider area used.<br>LPP: Similar to Alternatives 2, 3 and 5, with fewer beneficial impacts from revised LPP from retaining the Stehekin Valley Road alignment. |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
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| *(continued from previous page)* | | adverse effects from development and minor to moderate beneficial effects from potential acquisition of important riparian habitat areas.<br>Alternative 5<br>Impacts would be similar to Alternative 2, however, there would be additional minor to moderate adverse effects from construction of the Reroute Access Connector and minor adverse effects from construction of the box culvert at Milepost 8.5. | | |
| **Cumulative Impacts** | Alternative 1 would contribute long-term negligible to minor cumulative adverse and beneficial effects from habitat disturbance and loss. Alternatives 2, 3 and 5 would contribute localized minor to moderate adverse cumulative impacts and localized minor beneficial impacts on fish and wildlife. Alternative 4 would contribute localized minor to moderate adverse effects from both disturbance and loss. | | | |
| **Conclusion** | Alternative 1 would have negligible to moderate short- and long-term adverse and long-term beneficial impacts. Alternative 2 would have negligible to major adverse and negligible to moderate beneficial impacts. Alternative 3 impacts would be similar to Alternative 2, with short- to long-term negligible to major adverse impacts and long-term negligible to moderate localized beneficial effects from restoration. Compared to Alternative 2, Alternative 3 would have both adverse and beneficial effects would be somewhat less from shorter reroute, less potential restoration at Lower Field, and more erosion protection measures. Alternative 4 would have negligible to moderate adverse and beneficial effects. In Alternative 4, fewer overall beneficial effects would occur compared to Alternatives 2, 3 and 5, because the road would be retained in the channel migration zone and more erosion measures would also be within that zone.<br>Although localized impacts could range to major in Alternatives 2, 3 and 5 due to the disturbance of approximately 13 acres of wildlife habitat, within a total disturbed area of about 23 -24 acres, no species loss would occur and displaced species could use other nearby intact areas and future restored areas for habitat. | | | |
| **Special Status Fish and Wildlife** | | | | |
| **Actions Common to All Alterna-tives** | Impacts would be not likely to adversely affect most special status species because they would primarily be associated with short-term construction impacts. Impacts would be short-term and negligible on gray wolves and grizzly bears; short-term and minor for lynx and wolverine; short- and long-term minor on fishers (with some negligible beneficial effects from restoration of riparian areas); and short-term negligible to minor on bald eagles. Most effects on aquatic species, including fish, frogs, and toads would be avoided by work outside the breeding season. | | | |
| **Actions Differing Between Alterna-tives** *(continued on next page)* | Road rehabilitation: Approximately 7.5 acres of northern spotted owl suitable habitat could be affected by noise and disturbance, a short- to long-term minor to moderate adverse effect, primarily associated with road rehabilitation. | Alternative 2<br>Impacts would be the same as in Alternative 1 for all special status species except northern spotted owls, goshawks and aquatic species.<br>Road reroute: Impacts on northern spotted owls would be long-term and moderate to major associated | Same as Alternative 2. | Same as Alternative 1 with increased effects from creating pool habitat. |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| *(continued from previous page)* | | with both noise and disturbance and habitat removal. Long-term negligible to minor beneficial impacts could occur from changes to foraging areas.<br>Removal of forested habitat for the reroutes would also have moderate adverse effects on goshawks.<br>Erosion protection: There would be short- and long-term minor to moderate adverse impacts from work in or near water and minor beneficial impacts from reducing impacts in some habitat areas.<br>Alternative 5<br>Similar to Alternative 2, with some additional impacts associated with construction of the Reroute Access Connector and modifications to erosion protection measures. | | |
| **Cumulative Impacts** | Alternatives 1 - 5 would contribute long-term, cumulative negligible to minor beneficial impacts along with similar short-term adverse impacts from construction. Cumulative effects in Alternatives 2, 3 and 5 would be greater associated with direct adverse impacts to northern spotted owl habitat. | | | |
| **Conclusion** | Alternatives 1 - 5 may affect and would be likely to adversely affect northern spotted owls. Alternatives 1 - 5 may affect, but would not be likely to adversely affect the following listed, proposed or candidate species: grizzly bears, gray wolves, Canada lynx, Pacific fisher, bull trout, dolly varden, Chinook salmon, westslope cutthroat trout, or Columbia spotted frog. Similarly, the proposed actions may affect, but would not be likely to adversely affect the following mammal, bird, and amphibian federal species of concern: mammals: California wolverine and western gray squirrel; birds: bald eagle, Pacific Townsend's big-eared bat, small-footed (Yuma) myotis, western long-eared myotis, fringed myotis or long-legged myotis, peregrine falcon, northern goshawk, olive-sided flycatcher, and black swift; and amphibians: western toad, spotted frog, Cascades frog, and tailed frog.<br>Northern spotted owls may have become extirpated from their existing nest site prior to project implementation by barred owls, or may return to the nest activity area. If found in the area, project actions in that area would not occur until after the nesting season. Other northern spotted owl nest sites within the lower Stehekin Valley would likely continue to produce young. Visitors and residents would likely continue to have the opportunity to experience rare glimpses of this threatened species and it would continue to occur in the lower Stehekin Valley. | | | |
| **Archeological Resources** | | | | |
| **Actions Common to All Alterna-tives** | Because archeological resources have been surveyed for within the proposed project area; because archeological resources found were outside of the project area; and because the discovery potential for buried archeological resources would employ mitigation measures noted below there would be no adverse effect on known archeological resources. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Cumulative Impacts** | There would be no construction-related contributions that would affect known eligible archeological resources and therefore no cumulative impacts from Alternatives 1 - 5. There is a slight possibility; however, that future proposed work could affect currently unidentified cultural resources. Because mitigation measures would be implemented as noted above, Alternatives 1 - 5 would not be expected to contribute to cumulative effects on archeological resources. | | | |
| **Conclusion** | Alternatives 1 - 5 would have no adverse effect on known archeological resources. There would be no adverse effects on National Register eligible archeological resources or values. | | | |
| **Cultural Landscapes** | | | | |
| **Actions Differing Between Alterna-tives** | No effect on cultural landscapes. | Alternatives 2 and 5<br>Minor long-term beneficial effects on rehabilitation of the cultural landscape at Buckner Homestead Historic District from vegetation restoration of the riparian edge along the pasture and hayfield. Vegetation restoration of the riparian area would have no adverse effect on the Buckner Homestead Historic District. | Same as Alternative 2 | Same as Alternative 2 |
| **Cumulative Impacts** | Actions in Alternative 1 would have no contribution to cumulative effects on cultural landscapes. Alternatives 2 - 5 would contribute minor long-term beneficial effects. | | | |
| **Conclusion** | Alternative 1 would have no effect on cultural landscapes. Alternatives 2 - 5 would have long-term beneficial effects (no adverse effect) on rehabilitation of the cultural landscape at Buckner Homestead Historic District from vegetation restoration of the riparian edge along the pasture and hayfield. Vegetation restoration of the riparian area would have no adverse effect on the Buckner Homestead Historic District. | | | |
| **Visitor Experience: Access and Transportation** | | | | |
| **Actions Common to All Alterna-tives** | Negligible to moderate adverse short-term adverse impacts from transportation of materials and supplies for projects, causing an increase in barge loads and truck traffic as well as delays on road (such as one lane closures). Long-term minor to moderate beneficial impacts from surfacing, a safer roadway, more pullouts and better signage. Minor to moderate beneficial effects from construction of Lower Valley Trail. | | | |
| **Actions Differing Between Alterna-tives** *(continued on next page)* | Road grade raise: Additional short-term moderate adverse impacts from importing and transporting fill.<br>Retaining road: Ongoing long-term moderate impacts from difficult access in McGregor Meadows section during flooding. | Alternative 2<br>Road reroute: Short-term minor to moderate adverse impacts from transportation of materials (fewer than Alternatives 1 and 4 because most within area of reroute) and moderate to major long-term beneficial impacts from increased reliability of access.<br>Access Road: Ongoing long-term minor to moderate difficulty of | Same as Alternative 2 except for impacts associated with river access point.<br>Erosion protection: There would be fewer potential impacts on rafting from barbs, but more from logjams. | Road grade raise / Stehekin Valley Road retention: Same as Alternative 1.<br>Erosion protection: Minor to moderate adverse effects from potentially protruding barbs during raft trips.<br>Milepost 8.0 / River access point: Same as Alternative 2. |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| *(continued from previous page)* | | access during flooding and minor adverse impacts from backtracking on the access road.<br>Erosion protection: Negligible to minor adverse impacts from potentially protruding barbs during raft trips.<br>Milepost 8.0: Long-term beneficial impacts from reduced potential for road closures due to rock fall.<br>River access point: Long-term minor to moderate beneficial effects.<br>Alternative 5<br>Same as Alternative 2, plus additional long-term beneficial effects to some residents from construction of Reroute Access Connector. | | |
| **Cumulative Impacts** | Alternatives 2, 3 and 5 would contribute long-term minor to moderate beneficial impacts from dependable road access around McGregor Meadows, while Alternative 2 would also contribute long-term dependable road access to above the Lower Field area. With erosion protection measures, Alternatives 2, 3 and 4 would likely result in better access than Alternative 1 from bank stabilization and from work at Milepost 9.2 and from slope stabilization at Milepost 8.0. Alternative 5 would improve access for some residents from the Reroute Access Connector. All alternatives would contribute short-term minor to moderate adverse effects on transportation that would generally affect residents more than visitors. These include traffic delays from transport of fill and construction materials and other road construction activities. Similarly long-term negligible to minor beneficial effects on transportation would be contributed under Alternatives 1 - 5 from rehabilitation of the road (Alternatives 1 - 5) or construction of new segments of road (Alternatives 2, 3 and 5) from improved driving conditions, signage, and safety improvements such as sight distance and pullouts. | | | |
| **Conclusion** | Alternatives 1 - 5 would have short-term negligible to moderate adverse and negligible to minor beneficial impacts. Additional moderate adverse effects would occur in Alternatives 1 and 4 related to transportation of fill and flooding access. Alternatives 2 - 5 would add long-term minor to moderate beneficial effects from actions at Milepost 8.0 and from stabilization of the road, whether in place or with a reroute, though these would be greater in Alternatives 2, 3 and 5 from increased reliability of access. Additional minor adverse impacts would occur from erosion protection measures. | | | |
| **Visitor Experience: Interpretation and Education** | | | | |
| **Actions Common to All Alternatives** | Ongoing minor to moderate beneficial impacts from existing interpretive and educational programs. Minor long-term beneficial effects from opportunities for interpretation / education on Lower Valley Trail. Short-term minor beneficial impacts from informal interpretive opportunities during construction. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Actions Differing Between Alternatives** | Same as Actions Common to All Alternatives. | Alternatives 2 and 5<br>Long-term minor to moderate long-term beneficial effects from other new interpretive opportunities associated with new recreational facilities.<br>Long-term minor beneficial effects from enhancement of interpretive and educational programming related to the implementation plan. | Same as Alternative 2 | Same as Alternative 2 |
| **Cumulative Effects** | Alternatives 1 - 5 would contribute minor beneficial effects. | | | |
| **Conclusion** | Alternatives 1 - 5 would have minor to moderate beneficial effects, with slightly more beneficial effects in Alternatives 2 - 5. | | | |
| **Visitor Experience: Visitor Use Opportunities** | | | | |
| **Actions Common to All Alternatives** | Long-term minor to moderate beneficial impacts from ongoing visitor use opportunities. Long-term moderate to major beneficial impacts from improved driving conditions on a surfaced road, new experiences on Lower Valley Trail, an improved winter turnaround, and reduced dust on the road for motorists and recreationists. Negligible to minor, short-term minor to moderate adverse effects from noise and activity and reduced wildlife presence due to road rehabilitation and construction of housing and maintenance areas. | | | |
| **Actions Differing Between Alternatives** | Same as "Actions Common to All Alternatives." | Alternatives 2 and 5<br>Road reroute: There would be long-term minor effects from the increased diversity of the driving experience and from changes in views and vistas that would be negligible to minor beneficial or adverse depending on individual preferences. Long-term negligible beneficial effects from increased wildlife sightings in the Lower Field area.<br>Recreation: Negligible to minor adverse and minor to moderate long-term beneficial effects from establishing additional or improved camps and river access point. Minor beneficial effects on fishing from creation of pool habitat and riparian restoration. | Recreation: Similar to Alternative 2 except fewer beneficial and adverse impacts form no river access point and one additional camp. | Same as Alternative 2, but with additional beneficial impacts from one additional camp. |

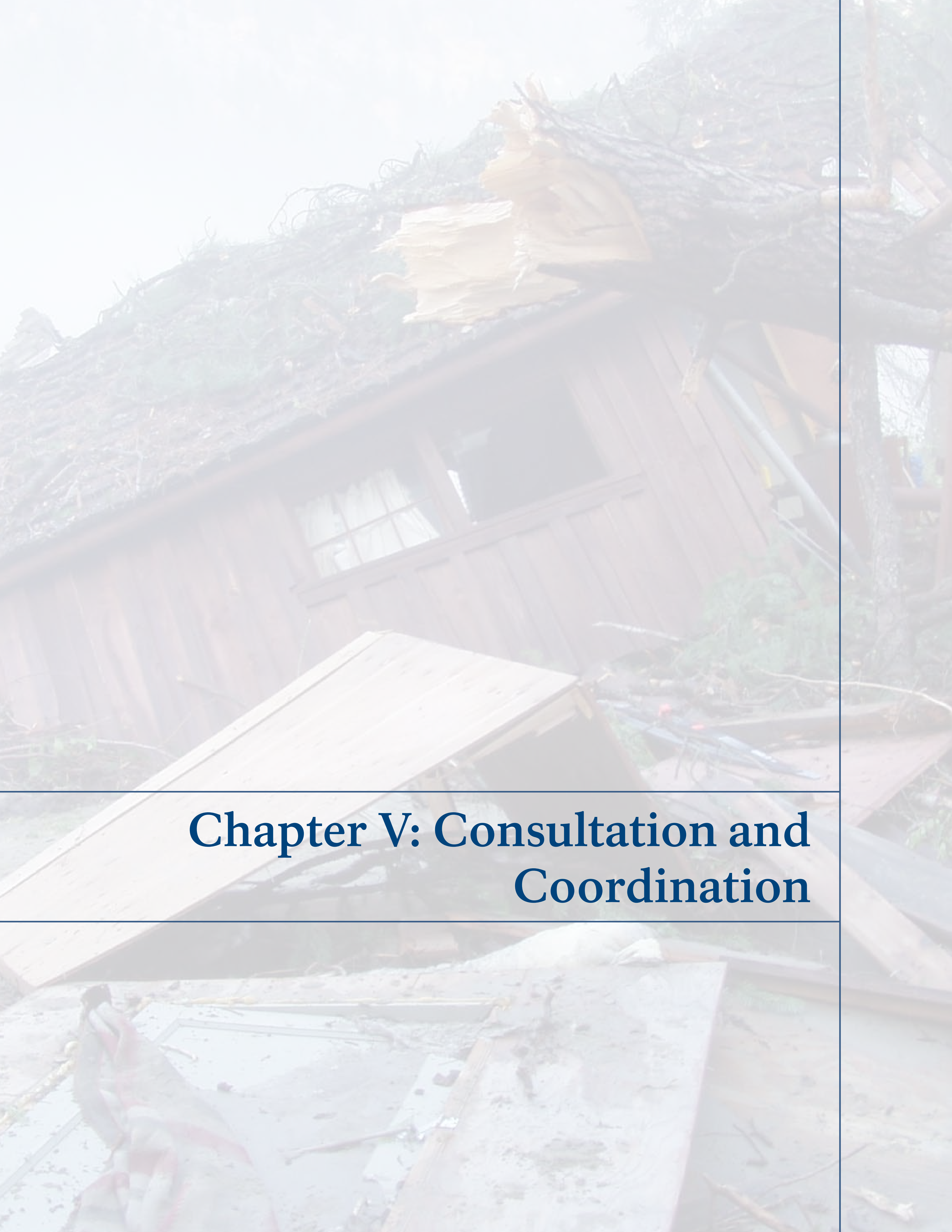
| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Cumulative Effects** | Alternative 1 would contribute minor to moderate beneficial impacts and negligible to minor short-term adverse effects. Alternatives 2 - 5 would be the same as Alternative 1 plus would have additional minor beneficial effects from new visitor facilities. Depending on the viewer, changes to the driving experience would be viewed (in Alternatives 2, 3 and 5) as minor and beneficial or adverse. | | | |
| **Conclusion** | There would be few new opportunities in Alternative 1; however there would be improvements in existing opportunities. Compared to the negligible to minor beneficial effects in Alternative 1, Alternatives 2 - 5 would have both more opportunities and more improvements (minor to moderate beneficial effects) than Alternative 1. | | | |
| **Visitor Experience: Safety** | | | | |
| **Actions Common to All Alternatives** | Impacts from Actions Common to All Alternatives: All alternatives would contribute a series of long-term negligible to moderate beneficial effects on safety primarily associated with road improvements (pullouts, surfacing, etc.) and maintenance area replacement and relocation. Negligible to moderate adverse effects from retaining sections of the road within the floodplain. | | | |
| **Actions Differing Between Alternatives** | Road grade raise / road retention: Minor to moderate long-term adverse effects from maintaining more road vulnerable to flooding. | Alternatives 2 and 5<br>Road reroute: Long-term moderate beneficial effects from rerouting the road away from the river. Long-term negligible to moderate adverse effects from relocation of the road.<br>LPP: Moderate beneficial effects from removing additional development from the floodplain. | Same as Alternative 2. | Same as Alternative 1 plus additional minor to moderate beneficial effects from revised LPP. |
| **Cumulative Effects** | While Alternatives 1 and 4 provide minor safety improvements, Alternatives 2 and 3 would result in long-term moderate beneficial impacts from improving safety conditions related to rerouting the road; as a result Alternative 2 would have slightly greater benefits. | | | |
| **Conclusion** | Alternatives 1 and 4 would contribute negligible to moderate beneficial impacts on safety, while Alternatives 2, 3 and 5 would also have additional moderate beneficial impacts because of the reroute and changes in LPP priorities. There would also continue to be negligible to moderate adverse effects from retaining sections of the road in the floodplain / channel migration zone where it cannot be moved (Alternatives 2, 3 and 5) or to retain the existing road alignment (Alternatives 1 and 4). | | | |
| **Visitor Experience: Scenic Resources** | | | | |
| **Actions Common to All Alternatives** | Negligible short-term effects from construction. Long-term negligible to moderate adverse and beneficial effects from new actions, including from surfacing and restoration. | | | |
| **Actions Differing Between Alternatives** *(continued on next page)* | Road retention: No effect.<br>LPP: Ongoing minor beneficial effects from protecting scenic resources from acquisition and exchange along the Stehekin Valley Road. | Alternative 2<br>Road reroute: Long-term minor to moderate beneficial or adverse effects, depending on the viewer.<br>Erosion protection: Long-term minor beneficial and adverse impacts. | Same as Alternative 2 with slightly less restoration and more erosion protection measures. | Same as Alternative 1 plus:<br>Additional beneficial and adverse impacts from erosion protection measures and from revised LPP. |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| *(continued from previous page)* | | Restoration: Long-term minor to moderate beneficial effects.<br>LPP: Minor to moderate beneficial impacts from revised LPP.<br>Alternative 5<br>Similar to Alternative 2. | | |
| **Cumulative Impacts** | Alternative 1 would continue to contribute long-term negligible to minor beneficial effects and ongoing short-term adverse effects from construction activities / prescribed burns. Alternatives 2 - 5 would contribute the same adverse and beneficial effects as Alternative 1, plus long-term adverse and beneficial effects from road reroute. Long-term beneficial effects noted in Alternative 1 associated with the LPP would continue but there would be less emphasis on these. Similarly, Alternatives 1 and 4 would contribute additional long-term negligible to minor adverse effects from maintaining roads in their existing alignments, contributing both minor adverse and minor beneficial effects on scenic resources from maintaining views while altering natural processes. | | | |
| **Conclusion** | Alternatives 1 - 5 would continue to have long-term negligible to minor beneficial and short-term negligible to minor adverse effects on scenic resources, while Alternatives 2, 3 and 5 would contribute to the diversity of the Stehekin Valley Road driving experience, a long-term minor to moderate beneficial or adverse effect depending on the viewer. | | | |
| **Wild and Scenic Rivers** | | | | |
| **Actions Common to All Alterna-tives** | Minor beneficial effects would occur from the creation of the Lower Valley Trail and its connection to the Stehekin River Trail. No effect on the following outstandingly remarkable values: prehistoric resources, geology, scenic resources, wildlife or fish. | | | |
| **Actions Differing Between Alterna-tives** | Same as Actions Common to All Alternatives | Alternatives 2 and 5<br>Negligible to minor beneficial effects on historic resources. Minor beneficial effects on recreation from the designation of some additional camps and a river access point. Negligible to minor adverse effects from additional barbs or logjams where the road needs to be maintained near steep sections. | Additional negligible to minor adverse and beneficial effects on recreation from additional erosion protection measures and new recreational facilities. | Same as Alternative 3, with a different array of erosion protection measures. |
| **Cumulative Impacts** | No effect on eligibility of Stehekin River Segment 1 to be designated as a wild and scenic river for recreation. Minor beneficial effects on recreation in Alternative 1. Minor beneficial effects on historic resources, recreation and negligible to minor adverse effects from erosion protection measures in Alternatives 2 - 5. Removal of private cabins from along the river would contribute long-term moderate beneficial effects. | | | |
| **Conclusion** | There would be no effect on the ability of the Segment 1 portion of the Stehekin River to be designated as a wild and scenic river for recreation. The river would continue to be free flowing with unobtrusive and short impediments to river flow and would continue to possess more than one outstandingly remarkable value. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Park Operations** | | | | |
| **Actions Common to All Alternatives** | Short-term minor adverse effects from additional staff time and delays associated with planning, road construction, facility improvements and other actions. Long-term negligible to moderate beneficial effects from maintaining new and old facilities in good condition, with fewer needs for repair and fewer adverse effects during seasonal and catastrophic flooding. Long-term major beneficial effects from more functional maintenance facilities and from location not impacted by flooding. Long-term beneficial effects from cost-savings from new maintenance facility and housing. | | | |
| **Actions Differing Between Alternatives** | Retention of Road: Short-term minor to moderate adverse and long-term minor beneficial effects.<br>LPP: Short- and long-term negligible to moderate beneficial impacts.<br>New facility construction: Short-term negligible to moderate adverse impacts from oversight and management. | Alternative 2<br>Road reroute: Negligible to minor short-term adverse effects plus long-term moderate beneficial effects.<br>Access Road: Minor to moderate adverse effects.<br>Erosion protection: Negligible to moderate adverse and long-term beneficial effects.<br>LPP: Minor to moderate beneficial effects.<br>Alternative 5<br>Same as Alternative 2 plus:<br>Reroute Access Connector: Minor to moderate adverse effects.<br>Housing: Some beneficial effects from more integration of housing, coupled with negligible to minor adverse impacts from increased travel time to service housing in different areas. | Same as Alternative 2 | Same Alternative 1 with additional minor impacts from revised LPP and from erosion protection measures. |
| **Cumulative Impacts** | There would be cumulative beneficial impacts from reconstruction of the maintenance area under all alternatives and from rerouting a portion of the Stehekin Valley Road out of the floodplain under Alternatives 2, 3 and 5. Beneficial effects would also occur from relocating housing. Alternative 1 would continue to contribute moderate cumulative adverse effects on park operations from retaining the road within the floodplain / channel migration zone because of ongoing needs to repair it. Similarly, although Alternative 4 would harden the road, it would contribute minor adverse cumulative impacts because additional measures would likely be needed to retain it over time. Alternatives 2, 3 and 5 would also continue to contribute minor cumulative adverse impacts from maintaining the McGregor Meadows Access Road and (in Alternative 5) the Reroute Access Connector. Depending on the number of properties that were exchanged or acquired, there would be cumulative beneficial effects from implementation of the 2010 or 2012 LPPs. The degree to which these would occur, however, would be dependent on individual property owners coming forth to take advantage of the opportunities offered by these plans. | | | |
| **Conclusion** | Alternatives 1-5 would have short-term adverse and long-term beneficial effects from the new maintenance facility. Alternatives 2, 3 and 5 would have long-term beneficial effects from relocating the road. Impacts in Alternatives 1 and 4 would be moderate to major and adverse from ongoing need to maintain road in a floodplain. Alternatives 1-5 would also have a range of minor beneficial and adverse effects from implementing other aspects of the plan because of need to implement operations related to them. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Socioeconomics** | | | | |
| **Actions Common to All Alternatives** | Impacts from Actions Common to All Alternatives: Ongoing long-term beneficial effects from NPS presence. Short-term minor to moderate beneficial effects from slight growth in construction during maintenance and housing and Lower Valley Trail project implementation. | | | |
| **Actions Differing Between Alternatives** | Road rehabilitation: Short-term minor to moderate beneficial effects from construction.<br>LPP: Long-term negligible to minor beneficial effects. | Alternative 2<br>Road reroute: Short-term minor to moderate beneficial effects from construction.<br>LPP: Long-term negligible to minor beneficial effects.<br>Alternative 5 | Same as Alternative 2 | Same as Alternative 1 with additional beneficial impacts from LPP. |
| **Cumulative Impacts** | Alternatives 1 - 5 would contribute long-term minor beneficial effects from cost savings associated with construction of new maintenance and housing. Alternatives 2 - 5 would contribute negligible long-term economic benefits from reduced closures of the Stehekin Valley Road related to flooding. | | | |
| **Conclusion** | Alternative 1 would have negligible to minor adverse effects and negligible to moderate beneficial effects. Alternatives 2, 3 and 5 would have negligible to minor adverse effects and negligible to moderate beneficial effects, more than Alternative 1 because of more construction and road remaining open more. Alternative 4 would have the same negligible to minor adverse effects as Alternative 1 and the similar negligible to moderate beneficial effects as Alternatives 2, 3 and 5, however, the beneficial effects in Alternative 4 would be less related to road conditions. | | | |
| **Hazardous Materials** | | | | |
| **Actions Common to All Alternatives** | Impacts from Actions Common to All Alternatives: Potential short-term minor to moderate adverse effects from removing maintenance area and flood-affected structures and long-term moderate to major beneficial effects from removing hazardous materials from the floodplain. | | | |
| **Actions Differing Between Alternatives** | Same as Actions Common to All Alternatives | Alternatives 2 and 5<br>Short-term minor to moderate adverse effects from potential clean-up actions associated with former shooting range. | Same as Actions Common to All Alternatives | Same as Actions Common to All Alternatives |
| **Cumulative Impacts** | There would be no additional long-term contribution to adverse cumulative effects from Alternatives 1 - 5. Impacts would be minor to moderate, long-term and beneficial from removal of potential areas of hazardous materials in the former maintenance area and at the shooting range. | | | |
| **Conclusion** | Alternatives 1 - 5 would have minor to moderate adverse and moderate to major long-term beneficial effects from removing hazardous materials from the floodplain. There would be additional minor adverse and moderate beneficial impacts in Alternative 2 from removing the shooting range. | | | |
| **Unavoidable Adverse Impacts** | | | | |
| **Actions Common to All Alternatives** | Moderate to major adverse impacts from presence of development remaining within floodplain / channel migration zone, including on Company Creek Road, portions of the Stehekin Valley Road, erosion protection structures and on private lands. | | | |

| | Alternative 1 | Alternatives 2 and 5 (Preferred) | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Actions Differing Between Alterna-tives** | Ongoing moderate adverse effects partially mitigated by long-term minor to moderate beneficial effects from potentially reducing development in floodplain / channel migration zone. | Alternatives 2 and 5<br>Additional mitigation of ongoing adverse effects from removing a portion of the Stehekin Valley Road from floodplain / channel migration zone and from potentially reducing development in floodplain / channel migration zone. | Slightly less mitigation than Alternative 2 from shorter road reroute and same LPP revisions. | Slightly more mitigation than Alternative 1 from LPP revisions. |
| **Conclusion** | Alternatives 1 - 5 would continue to have moderate to major adverse impacts from development remaining within the floodplain / channel migration zone, including private homes, roads and the Company Creek levee. Alternatives 2 - 3 would improve conditions by removing a portion of the Stehekin Valley Road from the floodplain / channel migration zone and Alternatives 2 - 5 would also allow removal of private development from the floodplain / channel migration zone through a revised emphasis in the LPP. Ongoing minor to moderate adverse effects would continue from existing (Alternatives 1 - 5) and new (Alternatives 2 - 5) erosion protection structures along the banks of the Stehekin. | | | |
| **Relationship Between Short-term Use of the Environment and Maintenance and Enhancement of Long-term Productivity** | | | | |
| **Actions Common to All Alterna-tives** | Long-term minor to moderate beneficial and adverse effects from restoration of former maintenance area and development of new areas. | | | |
| **Actions Differing Between Alterna-tives** | Same as Actions Common to All Alternatives | Alternatives 2 and 5<br>Same as common to all alternatives plus: Additional moderate adverse effects from developing the road reroute areas and additional minor adverse and beneficial effects from erosion protection and restoration | Same as Alternative 2 | Additional minor adverse and beneficial effects from erosion protection and recreation. |
| **Conclusion** | New development in Alternatives 1 - 5 would affect about 8 acres in Alternatives 1 and 4 and 22 acres in Alternatives 2, 3 and 5 plus some portion of the 37 acres of available exchange lands in Alternative 1 and some portion of the 24 acres of available exchange lands in Alternatives 2 - 5. Most of this land has been affected by human activities or is forested (reroutes). Restoration of more productive riparian areas would compensate for some of this loss, accounting for about 5.0 acres in Alt1, 7.88 acres in Alternative 2, 7.42 acres in Alternative 3 and 6.42 acres in Alternative 4. | | | |
| **Irreversible and Irretrievable Commitments of Resources** | | | | |
| **Actions Common to All Alterna-tives** | Short-term minor adverse impacts from use of building materials, particularly nonrenewable resources such as metals and minerals that taken from one area to another that could not be reused. Potential for removal of development and restoration in all alternatives but with impacts visible for many years in forested areas. | | | |
| **Conclusion** | Because development of the road and new facilities area currently affect only a very small percentage of the lower Stehekin Valley (see "Land Use Impacts" in this chapter) and would not undergo major changes as a result of the implementation of Alternatives 1 - 5, irreversible and irretrievable commitments would be minor in all alternatives. | | | |



# Chapter V: Consultation and Coordination

**Destruction of private cabin and damage to Upper Company Creek Road during the 2003 flood.**

# CHAPTER V: CONSULTATION AND COORDINATION

## A. HISTORY OF PUBLIC INVOLVEMENT

### 1. Public Scoping (General)

A press release and newsletter describing the intent to begin the public involvement process through comments on the proposed project was issued on January 7, 2008. The newsletter was distributed to approximately 350 people on Lake Chelan NRA's mailing list and was available in park visitor centers. The proposed project was also entered into the National Park Service (NPS) Planning, Environment, and Public Comment (PEPC) website/database.

The formal public scoping period for the *Stehekin River Corridor Implementation Management Plan Environmental Impact Statement* began on January 22, 2008 and ended on March 31, 2008. During this time, Lake Chelan NRA held three open house public meetings in Stehekin (January 22, 2008), Wenatchee (January 23, 2008) and Seattle (January 24, 2008). All parties wishing to express concerns or provide information about management issues which should be addressed in the forthcoming conservation planning and environmental impact analysis process were strongly encouraged to submit written comments.

Professional staff was available to introduce the project, give presentations on scientific data, answer questions, and to accept comments. The public was also encouraged to provide comments during the meetings or afterwards. In total, approximately 73 people attended the public meetings and approximately 226 comments were recorded on flip charts at the meetings (see Chapter II). Later, 21 public comment letters were also received, including letters from individuals, nonprofit organizations (the Wilderness Society, National Parks Conservation Association, and North Cascades Conservation Council), and one business. With the exception of concerns outside the scope of the plan, these comments were used to inform preparation of the preliminary alternatives.

After the public comments were analyzed, a postcard announcing the public comment summary was posted on the North Cascades NPS Complex and PEPC websites. Individuals, agencies, organizations, and businesses were invited to view the public comments online beginning June 9, 2008 at *http://parkplanning.nps.gov/noca* and were notified that the process of developing alternative management strategies was beginning.

### 2. Public Scoping (Alternatives)

A second newsletter was prepared and sent out in summer 2008 describing the results of public scoping in more detail and identifying a range of preliminary alternatives. It was sent to the project mailing list, including the same individuals and organizations from the original mailing, plus the addition of individuals, organizations, and businesses who commented during public scoping.

Upon publication of the second (alternatives) newsletter, additional public scoping took place, focusing on these preliminary alternatives. Three public open houses were held: two in Stehekin (August 26 - 27, 2008) and one in Seattle (August 28, 2008). Afterwards, 17 additional comment letters were received from individuals; nonprofit organizations (National Parks Conservation Association, Western Lands Project, and Stehekin Heritage); the Stehekin School District, Chelan County and two businesses (Island Resources, Ltd., and Stehekin River Resort). These letters contained approximately 65 comments, which were considered in the revised alternatives.

## 3. Public Comments (DEIS)

The public comment period for the Stehekin River Plan closed on February 11, 2011 after an extended 150-day public review period, a two-day open house in Stehekin (September 29-30, 2011), and seven public meetings (Stehekin -- October 19, 2011, January 10, 2012, Wenatchee -- October 20, 2011, Seattle -- October 21, 2011, Sedro-Woolley -- January 12, 2012 ). Two interviews were provided by the SRCIP project manager to GoLakeChelan, an online forum for news about the region. This organization provided audio and written versions of the interviews on its website. These interviews were conducted in fall 2010 and winter 2011, during the 150 day public comment period after release of the DEIS. The superintendent and the project manager also gave briefings for a variety of community groups and organizations, including Chelan County Commissioners, state and federal representatives, and the Provincial Advisory Committee, which included representatives from the Okanogan-Wenatchee National Forest, among other participants. Approximately 140 copies of the DEIS, 400 Executive Summaries of the DEIS, and 300 copies of the 2010 Draft Land Protection Plan were printed and distributed during in-person briefings, at public meetings and to the mailing list for the project. Electronic versions of the document, both on CD-ROM and on the Planning, Environment, and Public Comment (PEPC) project website (*http://parkplanning.nps.gov/projectHome.cfm?projectID=20331*), were also made available to the public. A total of 872 individual comment letters were received on the plan. These comments provided valuable input about the future management of Lake Chelan NRA.

A printed set of comments received on the plan is available for public review at the Golden West Visitor Center in Stehekin and at the North Cascades NPS Complex headquarters in Sedro-Woolley. The public comments are also available online at: *http:\\parkplanning.nps.gov\SRCIP*.

These 872 comment letters included 34 letters sent via the U.S. Postal Service, 78 PEPC comment letters and 760 email comment letters (not including duplicates). Of these 637 were sent through the National Parks Conservation Association, 19 were from members of the Backcountry Horsemen and approximately 50 letters were from those affiliated with or who mentioned support of Stehekin Heritage comments. Two other form letters of unknown origin were also received (3 each of two different letters).

The following agencies and organizations submitted comments (see Appendix 21):

Agencies:

- Federal Highway Administration
- Environmental Protection Agency
- Washington Department of Transportation
- Washington Department of Ecology
- Chelan County

Organizations:

- National Parks Conservation Association
- North Cascades Conservation Council
- The Mountaineers
- Stehekin School District
- Stehekin Heritage
- Buckner Homestead Heritage Foundation
- Island Resources, Ltd.
- Stehekin River Resort

Individual substantive and non-substantive comments were identified from the letters. In all approximately 1,361 individual comments were identified. Approximately 574 of these were identified as non-substantive (outside the scope or opinions). The comments were combined into similar categories or concern statements. A total of 173 concern statements were initially identified. Of these 57 (or 43 percent) were related to the Land Protection Plan (LPP); 30 were related to potential impacts (including some of the ones on the LPP); 19 concern statements were related to erosion protection measures; 19 were related to recreational facilities; 16 were related to the reroute; 14 to the maintenance / housing area; others identified a series of concerns, including regarding the purpose and need, planning process, use of materials, or offered new information or alternative options. Most of these LPP comments were about land exchanges or LPP priorities. Eventually, some additional combination and splitting of comment categories resulted in the 182 substantive concern statements responded to in Appendix 21.

## 4. Public Notification

The formal notice of intent to prepare an EIS was published in the *Federal Register* on February 27, 2008.

News releases mailed in advance of the public scoping and alternatives scoping periods were sent to the following news media: Seattle Times, Seattle Post Intelligencer, Chelan Mirror, Wenatchee World, Associated Press, Everett Herald, River Post, Argus, Spokane Chronicle, Bellingham Herald, Skagit Valley Herald, and Lynden Tribune.

Public notification also included the two newsletters and the postcard mentioned above, sent in January, June and August 2008. The project website (*www.nps.gov/noca/srcip*) was created in January 2008 and is periodically updated with new information.

During both the public scoping (general and alternatives) processes, comments were submitted directly to the park at the following address: North Cascades NPS Complex, Attn: SRCIP-EIS, 810 State Route 20, Sedro-Woolley, WA 98284. Comments were also submitted via the NPS PEPC website at *http://parkplanning.nps.gov/NOCA* or sent via e-mail to the superintendent, project manager, or NOCA_planning@nps.gov. Information about the planning process was regularly updated and posted on the park's website: *www.nps.gov/noca and on PEPC.*

## 5. Public Review (FEIS)

The FEIS will be available for public review for 30 calendar days from the date of this publication, which coincides with the NOA published in the Federal Register by the Environmental

Protection Agency (EPA). Following this 30 day period, the Federal Highway Administration (FHWA) and NPS will each issue a separate Record of Decision, which will identify the Responsible Officials' selected alternative and discuss the rationale for their decisions. The Regional Director, Pacific West Region, is the deciding official for the NPS and the Division Engineer, Western Federal Lands Highway Division is the deciding official for FHWA. The official responsible for implementation is the Superintendent, North Cascades National Park Service Complex.

The NPS in coordination with the Federal Highway Administration (FHWA) will also host public meetings in Stehekin, and Seattle, Washington to highlight the plan and answer questions. Meeting dates, locations and times will be announced via a news release, through PEPC (*http://parkplanning.nps.gov/noca*) and on the park's website (*www.nps.gov/noca*).

Public review of this FEIS will be responded to in the Record of Decision. For further information, please write to Palmer L. Jenkins, Superintendent, Attn: Stehekin River Corridor Implementation Plan FEIS, North Cascades National Park Service Complex, 810 State Route 20, Sedro-Woolley, Washington 98284-1239 or call the superintendent's assistant at (360)854-7201.

# B. AGENCY CONSULTATION AND COORDINATION

A variety of agencies have an interest in the outcome of the Environmental Impact Statement (EIS). The following discussion documents the consultation and coordination process undertaken by the NPS and Federal Highway Administration (FHWA) during the preparation of the SRCIP/DEIS and FEIS. All local governments, tribal governments, and federal and state agencies with resource management responsibilities or interests in Lake Chelan NRA were invited and encouraged to participate in the development of the Draft and Final SRCIP/EIS. Representatives of the planning team, including the North Cascades NPS Complex superintendent and SRCIP project manager made several presentations for key stakeholders, congressional officials, and NPS regional office management staff. Information from these contacts and correspondence is on file.

## 1. U.S. Department of Transportation, Federal Highway Administration

As noted in the beginning of this EIS, the lead agency for the preparation is the U.S. Department of the Interior, NPS at North Cascades NPS Complex (Lake Chelan NRA) and the cooperating agency is the FHWA(U.S. Department of Transportation). The FHWA has been involved in providing comments on draft versions of documents and in providing information relevant to describing the impacts related to road portions of the proposed actions discussed in the alternatives.

## 2. U.S. Environmental Protection Agency

The EPA submitted comments following their review of the notice of intent as well as minor comments on the DEIS. In the EPA comment letter on the DEIS received on February 11, 2011, EPA rated the DEIS as follows: Lack of Objections (LO), which is described as: The USEPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

## 3. U.S. Fish and Wildlife Service

The Endangered Species Act of 1973 as amended authorizes federal agencies to enter into early consultation with the USFWS to ensure that federal actions would not jeopardize the existence of any listed or proposed species or habitat. Consultation with the USFWS under Section 7 of the Endangered Species Act was initiated in January 2008 and updated in June 2008 and January 2009. The biological assessment based on the impact analysis in the DEIS (see Chapters III and IV "Special Status Species" sections) was used by the USFWS to prepare a Biological Opinion on the impacts of the preferred alternative on the northern spotted owl and other special status species (see Appendix 20). Changes in the preferred alternative could require additional consultation with the USFWS.

## 4. Native American Tribe Consultation

Consultation with Native American tribes under Section 106 of the National Historic Preservation Act is ongoing. Native American tribes who trace ancestry to Lake Chelan NRA were contacted several times during the planning process. During public scoping phase of the planning process, the following tribes were notified of the SRCIP/EIS process: Yakama Nation, Skagit System Cooperative, Sauk-Suiattle Indian Tribe, Nooksack Tribal Office, and Colville Confederated Tribes. In addition, North Cascades NPS Complex sent a letter to the Colville Confederated Tribes on October 7, 2009 notifying them of intent to consult on an undertaking and requesting concurrence on the Area of Potential Effect (APE). On November 15, 2009, the Complex received a reply from the Colville Confederated Tribes concurring with the APE as defined. Additional consultation letters (including a map of the preferred alternative and Federal Highway phase II designs of the proposed road reroute dated July 2011) were sent to the Yakama Nation and Colville Confederated Tribes on March 9, 2012 regarding the FEIS, with a particular focus on the reroute. A reply from the Yakama Nation was received on March 30, 2012 requesting additional information about the project area. The Complex responded to this request on May 16, 2012 in a letter and survey report that provided additional details about the proposed actions in the preferred alternative and further clarified the APE. The North Cascades NPS Complex Cultural Resources Branch Chief, archeologist, and superintendent have offered (and will continue to offer) representatives of these tribes opportunities to exchange information and to solicit comments and recommendations on the plan.

## 5. Washington State Historic Preservation Officer (SHPO)/ Advisory Council on Historic Preservation Consultation

The State Historic Preservation Officer (SHPO) and the Advisory Council are consulted regarding any proposals that might affect a cultural property listed on or eligible for the National Register of Historic Places.

In accordance with Section 106 of the National Historic Preservation Act of 1966 (as amended, 16 U.S.C. 470-470w-6), a letter notifying the Washington State Department of Archeology and

Historic Preservation (DAHP) of the proposed Stehekin River Corridor Implementation Plan was sent during public scoping, and a letter notifying the DAHP of intent to consult on an undertaking and requesting concurrence on the APE was sent on October 7, 2009. The Complex received a reply letter from the DAHP on October 15, 2009 that concurred with the APE as defined. A follow-up letter (including a map of the preferred alternative and Federal Highways phase II designs of the proposed road reroute dated July 2011) requesting concurrence with the determination of effect for the near-term proposals associated with the preferred alternative, with a particular focus on the reroute of the SRCIP, was sent to the DAHP on March 9, 2012. The DAHP responded with a request for more information on April 4, 2012. North Cascades NPS Complex responded to this request on May 17, 2012 in a letter and survey report that provided additional details about the proposed actions in the preferred alternative and further clarified the APE. If additional issues arise as a result of this response to the DAHP, these would be addressed in the Record of Decision (as applicable). Pending the Record of Decision additional consultation and formal concurrence from the SHPO with the determination of effect will be sought. Proposed undertakings associated with the SRCIP would have no adverse effect or no effect on known cultural resources.

If future undertakings that have the potential to affect resources potentially eligible for, eligible for or listed on the National Register of Historic Places are later identified under SRCIP implementation, NPS actions would fulfill all procedural requirements specified in 36 CFR 800 (as amended in August, 2004). No historic properties would be modified without consultation with the SHPO and the Advisory Council on Historic Preservation, as appropriate. Archeological sites would be protected in an undisturbed condition unless it is determined through consultation that disturbance or natural deterioration is unavoidable. When disturbance is unavoidable, appropriate treatment would follow in consultation with the Washington SHPO and applicable tribes (see above).

If more information becomes available, NPS staff would continue to consult with the SHPO.

## 6. Washington State Natural Resources Agencies

In addition to consultation with federal agencies, the NPS contacted the Washington Department of Fish and Wildlife, and the Washington State Department of Natural Resources (Washington Natural Heritage Program) to gather species information and additional concerns regarding the planning process. In addition, ongoing consultation with the Washington Department of Ecology also informed the process.

## 7. Stehekin River Corridor Implementation Plan Technical Committee

In addition to individual agency contacts regarding the development of the SRCIP/EIS, a technical committee was formed.

### Mission

To provide technical and regulatory information related to long-term river and floodplain management in the lower ten miles of the Stehekin Valley, Chelan County, Washington.

## Nature of Involvement

The committee met regularly during the 2-year planning and EIS preparation process. The schedule included working committee meetings and public meetings for scoping and alternative development. Meetings focused on review of technical information and proposed management alternatives, as well as other functions described below. The SRCIP technical committee was not used as a decision-making body.

## Functions

1. Help define the nature and scope of river and floodplain management issues;
2. Technical assessment of alternatives for mitigating erosion and flooding;
3. Assist with public education;
4. Assessment of the suitability of NPS exchange property;
5. Review NPS technical reports on sediment yield and channel change; and
6. Assist with development of a new regulatory floodplain map for lower Stehekin River Valley.

The technical committee met on the following dates: December 7, 2007 (Chelan), April 18, 2008 (Wenatchee), July 28 - 29, 2008 (Stehekin), and April 28, 2009 (Seattle).

## Membership

The following individuals from the identified agencies/organizations served on the Technical Committee and provided comments on initial proposals associated with the alternatives:

- National Park Service: Jon Riedel
- Chelan County: Mike Kaputa
- Chelan Public Utilities District: Bill Christman
- Geomax PC: Don Reichmuth
- Washington Department of Fish and Wildlife: Gina McCoy
- Washington Department of Ecology: Patricia Olson
- U.S. Army Corps of Engineers: Paul Komoroske, Doug Weber, and Les Soule
- U.S. Fish and Wildlife Service: David Morgan

# C. LIST OF PREPARERS / LIST OF PERSONS AND AGENCIES CONSULTED

# 1. U.S. Department of the Interior (DOI)

## National Park Service, North Cascades NPS Complex

*Main: 810 State Route 20, Sedro-Woolley, Washington 98284*
*Resource Division: 7280 Ranger Station Road, Marblemount, Washington 98267*

**Project Team**

- Chip Jenkins, Superintendent
- Jon Riedel, Geologist / Hydrologist (Project Manager, preparer)

- Mignonne Bivin, Plant Ecologist (preparer)
- Elizabeth Boerke, Environmental Protection Specialist (preparer)
- Vicki Gempko, Stehekin District Resource Management Specialist (preparer)
- Jesse Kennedy, Chief of Cultural Resources Branch (preparer)
- Bob Kuntz, Wildlife Ecologist (preparer)
- Jack Oelfke, Chief of Resource Management (preparer)
- Kerry Olson, former Stehekin District Interpretive Specialist
- Paul Slinde, Chief of Maintenance (former Stehekin Foreman)
- Roy Zipp, Environmental Protection Specialist (preparer)

**Other Staff**

- Charles Beall, Chief of Interpretation
- Nicole Bowerman, Physical Science Technician
- Anne Braaten, Geographic Information System Specialist (preparer)
- Sharon Brady, Physical Science Technician (preparer)
- Roger Christophersen, Wildlife Biologist (preparer)
- Reed Glesne, Aquatic Ecologist
- Shelley Kluz, Management Assistant
- Karen Kopper, Fire Ecologist
- Tom Langley, Maintenance Mechanic
- Bob Mierendorf, Archeologist (preparer)
- Ashley Rawhouser, Aquatic Ecologist (preparer)
- Stan Zyskowski, Biological Technician (Fisheries) (preparer)

## National Park Service, Pacific West Regional Office

**Seattle**

*Main: 909 First Avenue, Seattle, Washington 98304*
*Land Resources: 168 South Jackson Street, Seattle, Washington 98104*

- Keith Dunbar, former Chief, Division of Planning and Environmental Compliance
- Wayne Hill, Realty Specialist (project team)
- Amanda Kaplan, Environmental Planner (project team)
- Rose Rumball-Petre, Environmental Protection Specialist (project team, preparer)
- Anna Tamura, Landscape Architect / Planner
- Karen Vaage, Landscape Architect (project team)
- Rick Wagner, Chief, Division of Land Resources (project team)

**San Francisco**

*333 Bush Street #500, San Francisco, California 94104*

- Justin DeSantis, Landscape Architect, Federal Highway Program Liaison
- Alan Schmierer, Regional Environmental Coordinator

## Denver Service Center

*12795 W. Alameda Parkway, Denver, Colorado 80225*

- Jan Burton, Landscape Architect (Project Manager)
- Mark Pritchett, Section Chief, Park Roads and Parkways
- George Tait, Branch Chief of Roads
- Karen Vaage, Landscape Architect
- Bob Welch, Branch Chief, Transportation Division
- Sarah Wynn, Revegetation Technical Specialist

### Washington Office, Water Resources Division

*Natural Resources Stewardship and Science Directorate, Water Resources Division*
*1201 Oakridge Drive, Suite 250, Fort Collins, Colorado 80525*

- Bill Jackson, former Chief (retired)
- Gary Rosenlieb, Acting Chief
- Kevin Noon, Wetland Specialist
- Gary Smilie, Hydrology Program Team Leader
- Mike Martin, Hydrologist

## 2. U.S. Army Corps of Engineers

*Seattle District, P.O. Box C-3755, Seattle, Washington 98124-2255*

- Paul Komoroske
- Les Soule
- Doug Weber, Levee Safety Program Manager
- Amy Gibbons

## 3. U.S. Environmental Protection Agency

*Region 10, 1200 Sixth Avenue, Seattle, Washington 98101*

- Elaine L. Somers, NEPA Review Unit

## 4. U.S. Department of Transportation

*Federal Highway Administration, Western Federal Lands Highway Division*
*610 East 5th Street, Vancouver, Washington 98661*

- Juan Aguirre, former Civil Engineering Technician
- Adam Ahola, Highway Design Manager
- Betty Chon, Highway Engineer (Project Manager)
- Jennifer Corwin, Environmental Protection Specialist
- Sven Leon, Hydraulics Engineer
- Grant Lindsey, Civil Engineering Technician, Designer
- Craig Sanders, Construction Operations Engineer
- Curtis Scott, former Construction Operations Engineer
- Malcolm Ulrich, Engineering Geologist
- U.S. Fish and Wildlife Service
- Central Washington Field Office, 215 Melody Lane, Suite 119, Wenatchee, WA 98801
- David Morgan, Biologist

## 5. Washington Department of Fish and Wildlife

*Region 3 Office, 1701 South 24th Avenue, Yakima, Washington 98902*

- Gina McCoy, Central Washington Technical Assistance Engineer

## 6. Washington Department of Ecology

*Shorelines and Environmental Assistance Division, Ecology Headquarters Building, 30300 Desmond Drive SE, Lacey, Washington 98503*

- Patricia Olson, Senior Hydrogeologist

## 7. Chelan County

*316 Washington Street, Suite 401, Wenatchee, Washington 98801*

- Mike Kaputa, Director, Chelan County Natural Resource Department

## 8. Chelan County Public Utility District

*327 N. Wenatchee Ave, Wenatchee, Washington 98801*

- Bill Christman, Hydro Engineering Manager

## 9. Geomax

*1023 West 30th Avenue, Spokane, Washington 99203-1324*

- Don Reichmuth, Private Consultant for Geomax

# D. LIST OF AGENCIES, ORGANIZATIONS AND BUSINESSES THAT RECEIVED THE FEIS

## Federal Agencies

- Army Corps of Engineers
- Bureau of Land Management
- City of Rocks National Reserve
- Congressman Doc Hastings
- Congressman Jay Inslee
- Congressman Rick Larsen
- Congresswoman Cathy McMorris Rodgers
- Environmental Protection Agency, Region 10
- Lewis and Clark National Historical Park
- Mt Baker-Snoqualmie National Forest
- Mount Rainier National Park
- National Oceanic and Atmospheric Administration, Fisheries Program
- National Park Service, Office of the Regional Solicitor
- Okanogan-Wenatchee National Forest
- Senator Maria Cantwell
- Senator Patty Murray
- U.S. Army Corps of Engineers
- USDOT, Federal Highway Administration
- U.S. Fish and Wildlife Service

## State and Local Agencies

- Bellingham Public Library
- British Columbia Ministry of Environment
- Burlington Public Library
- Chelan County Board of Commissioners
- Chelan County Department of Natural Resources
- Chelan County Public Utility District
- Chelan Public Library
- Chelan Ranger District
- City of Chelan
- City of Concrete
- City of Mt. Vernon
- City of Sedro-Woolley
- City of Winthrop
- Cultus Lake Provincial Park
- Mount Vernon City Library
- Port of Chelan County
- Port Commissioner
- Representative Cary Condotta
- Representative Mike Armstrong
- Representative Dan Kristiansen
- Representative Kirk Pearson
- Seattle City Light - Newhalem
- Seattle Public Library
- Senator Dale Brandland

- Senator Linda Evans Parlette
- Senator Val Stevens
- Stehekin School District
- University of Idaho, Department of Forest Resources
- Washington Department of Archaeology and Historic Preservation
- Washington Department of Ecology
- Washington Department of Ecology, Shorelands Management Permits
- Washington Department of Natural Resources
- Washington Department of Natural Resources, Rivers District
- Washington Department of Fish and Wildlife
- Washington State Parks & Recreation Commission
- Washington Department of Transportation
- Washington Department of Transportation, Aviation Division
- Wenatchee Public Library
- Whatcom County Planning / Development Services

## Indian Tribes

- Colville Confederated Tribes
- Sauk-Suiattle Indian Tribe
- Swinomish Indian Tribe
- Upper Skagit Indian Tribe
- Yakama Nation

## Organizations and Businesses

- American Rivers
- American Whitewater
- Backcountry Horsemen
- Backcountry Horsemen of Washington
- Backcountry Horsemen: Methow Valley
- Bellingham Herald
- Blue Water Network
- Buckner Homestead Heritage Foundation
- Campbell's Resort
- Cascade Corrals
- Chelan Airways
- Chelan Seaplanes
- Conservation Northwest
- Defenders of Wildlife
- Earth Justice Legal Defense Fund
- Eigenvector Research, Inc.
- Friends of the Earth
- Geomax, P.C.
- Henry M. Jackson Foundation
- Hi Lakers
- Izaak Walton League
- Jeffers, Danielson, Sonn & Aylward, P.S.
- Lake Chelan Mirror
- Lake Chelan Recreation, Inc.
- Methow Conservancy
- Methow Valley News
- National Parks Conservation Association
- North Cascades Conservation Council
- North Cascades Institute
- North Central Washington Audubon Society
- Northwest Interpretive Association
- Northwestern University, Environmental Policy and Culture Program
- Pacific Crest Trail Association
- Paddle Trails Canoe Club
- REI (Bellingham, Lynnwood, Redmond, Seattle)
- Ross Lake Resort
- Seattle Times, Science/Environment
- Sierra Club - Cascades Chapter
- Skagit Valley Herald
- Stehekin Heritage
- Stehekin Landing Resort
- Stehekin Valley Ranch
- The Student Conservation Association
- The Henry M. Jackson Foundation
- The Herald
- The Mountaineers (Bellingham, Seattle)
- The Nature Conservancy of Washington
- The Wenatchee World
- The Wilderness Society
- Triangle Associates, Inc.
- Trout Unlimited
- Washington Kayak Club
- Washington Native Plant Society
- Washington Trails Association
- Washington Recreational River Runners
- Washington Water Trails Association
- Washington Wilderness Coalition
- Washington's National Park Fund
- Western Lands Project
- Whatcom Independent
- Wilderness Watch
- Wild Fish Conservancy

# E. LIST OF FEDERAL PERMITS

## 1. Clean Water Act Section 401 and Section 404

Each of the actions identified in Alternatives 1 - 5 involving work within waters of the U.S. would trigger the need to acquire Clean Water Act, Section 404 (wetlands) permits. These permits will either fall under existing nationwide permits, or could require individual permits. A section 401 (water quality) certification administered by the Washington Department of Ecology is also required. For rock barbs, a section 404 nationwide permit from the U.S. Army Corps of Engineers would be required.

Road construction activities require a National Pollution Discharge Elimination System (NPDES) permit under Section 402 of the Clean Water Act. This permit is also required for any activities that would disturb more than one acre of land, such as for the maintenance facility relocation. The project will require at least one National Pollutant Discharge Elimination System (NPDES) permit.

Hydraulic Project Approval (HPA) permits may also be required from the Washington State Department of Ecology as part of Washington State's implementation of the Clean Water Act.

If an easement is obtained to undertake work on private land at Wilson Creek, a shoreline permit from Chelan County which administers this program for the Washington State Department of Ecology may be necessary.

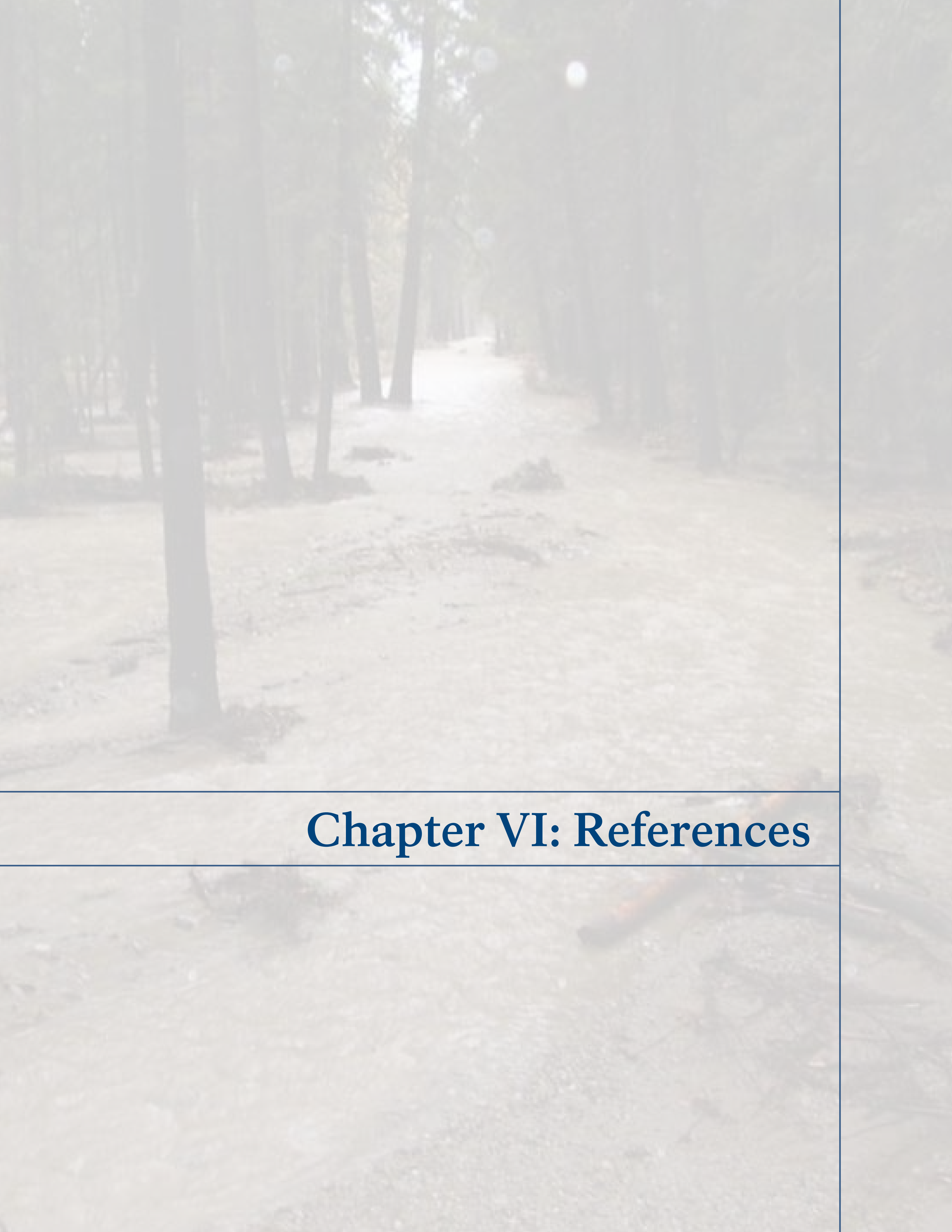
## 2. Endangered Species Act Section 7

The USFWS has stated that it is currently unlikely that an incidental take permit would be required for adverse effects to northern spotted owls. A biological opinion is attached as Appendix 20. No incidental take permit is required.

## 3. Code of Federal Regulations Rule Change

Under Alternatives 2 and 5, closure of the shooting range would require a change in a Code of Federal Regulations Part 7 regulation. Although this would not require a federal permit, it would require publication of a regulation change in the *Federal Register* and a change in the Superintendent's Compendium.

The current compendium states "Stehekin Shooting Range, as described in 36 CFR 7.62(c), is closed to the discharge of firearms from March 15th to June 15th." This closure is in effect because of potentially nesting northern spotted owls. No alternate site is mentioned as being available for use during this time period; the compendium simply closes the existing site during this period.



# Chapter VI: References

**Stehekin Valley Road in McGregor Meadows during the 2006 flood.**

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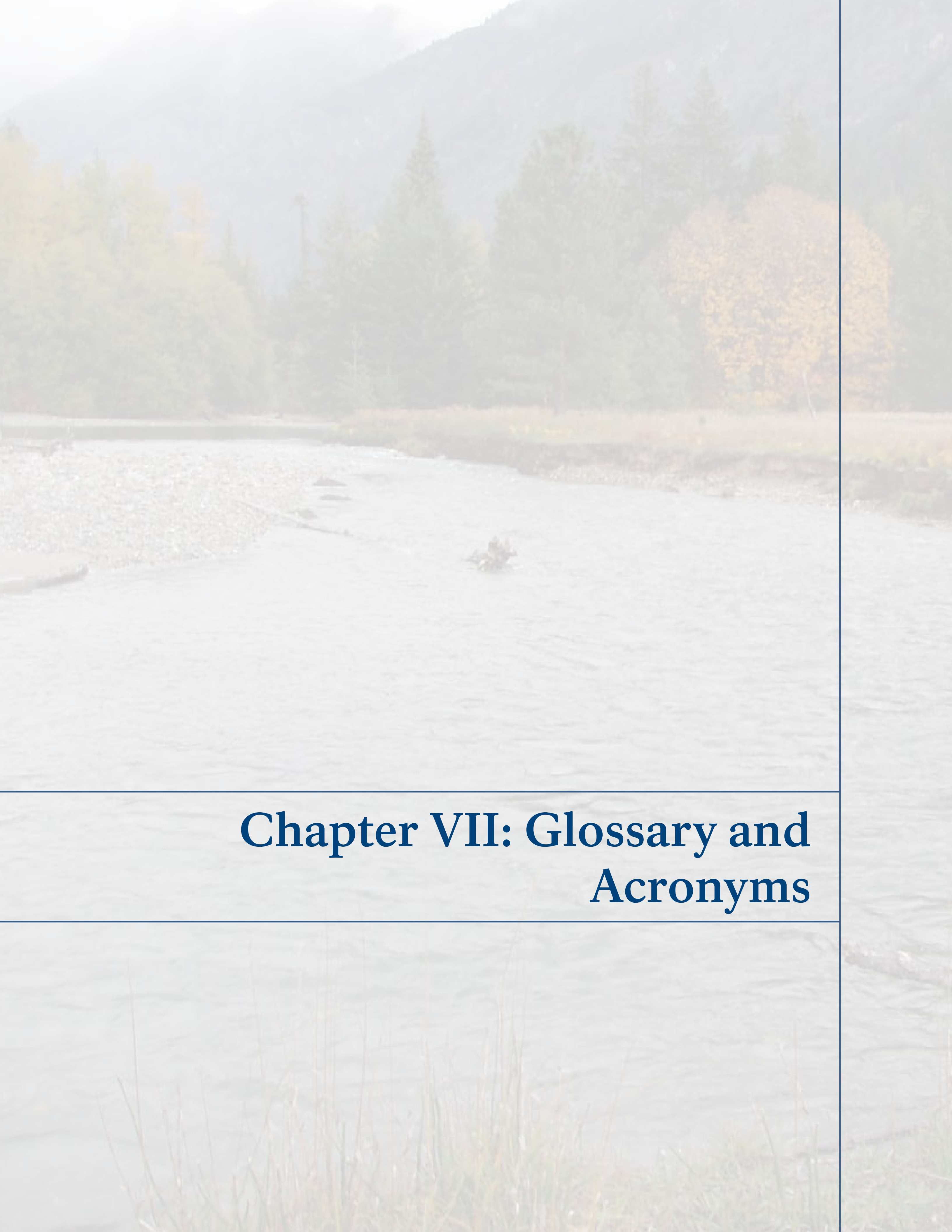


# Chapter VII: Glossary and Acronyms

**Stehekin River at Buckner Orchard (the photo shows part of the buffer restoration site).**

# CHAPTER VII: GLOSSARY AND ACRONYMS

## A. GLOSSARY DEFINITIONS

**Adfluvial:** A fish that lives in lakes and migrates into rivers or streams to spawn.

**Affected Environment:** Existing natural, cultural, social, and recreational conditions of an area, potentially subject to change indirectly or directly as a result of human action.

**Alternatives:** Sets of management elements that represent a range of options for how, or whether to proceed with a proposed action. An environmental assessment or environmental impact statement analyzes the potential environmental impacts of the range of alternatives, as required under National Environmental Policy Act (NEPA).

**Alluvial Fan:** An outspread, gently sloping mass of alluvium deposited by a stream. Viewed from above, it has the shape of a fan, the apex being at the valley mouth.

**Area of Potential Effect:** The geographic area or areas where an undertaking has the potential to affect historic properties. The APE consider physical, visual, auditory, and atmospheric effects as well as potential changes in land or building use, change in the setting, and potential for neglect.

**Archeological Resources:** Historic and prehistoric deposits, sites, structures, and other remains from a human culture from an archeological site.

**Asphalt Pulverizing:** Pulverizing is the process of breaking apart existing road asphalt into an aggregate (gravel-like) mixture, sometimes blending the recycled aggregate with new aggregate and reusing it as subgrade for newly laid asphalt. Pulverizing is a cost effective and environmentally appropriate way to reconstruct existing pavement. The process eliminates the expensive and environmentally damaging excavation and trucking of the existing asphalt and it creates a stronger base course.

**Avulsion:** A major change in the location of a river channel.

**Bankfull:** When a river is at maximum carrying capacity and its waters come up to the height of the bank.

**Bankfull Stage:** The elevation of the water surface of a stream flowing at channel capacity.

**Batholith:** A large mass of igneous rock that formed when magma was emplaced at depth and was subsequently exposed by erosion.

**Berm:** A shaped mound of earth. It is intended to direct traffic or flow away from an area.

**Best Management Practices:** Effective, feasible (including technological, economic and institutional considerations) conservation practices and land and water management measures that avoid or minimize impacts to natural and cultural resources. Best management practices may be physical, organizational, prohibitions, or management practices.

**Bioengineering:** Bioengineering is the use of plants to stabilize riverbanks and slopes. In Stehekin, National Park Service (NPS) favors use of a layering technique with long whips of willow, dogwood, and coconut fabric, which decomposes over time. First, as plants grow and roots develop, the structure gets stronger with time. Second, native shrubs grow quickly, and do not add weight to the bank.

Bioengineering provides several benefits. First, the plants provide shade and woody debris, an important component of aquatic habitat. They also provide habitat for birds, small mammals, and amphibians (NPS 2005: 25).

**Borrow Pit:** An excavated area where material has been dug for use at another location (e.g., sand, rock, and gravel).

**Candidate Species:** Those species being considered by the U.S. Fish and Wildlife Service for listing as threatened or endangered as published in the Federal Register.

**Council on Environmental Quality (CEQ) Regulations:** The CEQ was established by the NEPA and given the responsibility of developing federal environmental policy and overseeing the implementation of NEPA by federal agencies.

**Channel Migration Zone (CMZ):** The historic area within which the Stehekin River has migrated over time (does not include tributary migration area).

**Chipseal:** A road-surfacing treatment composed of asphalt emulsion covered with crushed aggregate (gravel chips).

**Cirque:** A deep, steep-walled basin on a mountain, usually forming a blunt end of a valley.

**Compatibility Criteria:** The basis for determining which land uses are consistent with the recreation, scenic, scientific, natural, and historic values of Lake Chelan National Recreation Area.

**Crushed Aggregate:** Gravel.

**Cultural Landscape:** Cultural landscapes are defined as areas that reflect human adaptation and use of natural resources during one period or over time, as expressed in the way that land is organized and divided into patterns of settlement, land use, circulation systems, and structures. Cultural landscapes may be comprised of a series of historic districts or may be the landscape associated with one district.

**Culvert:** Plastic, PVC, or corrugated metal pipe used to convey water under a road.

**Cumulative Effect or Impact:** "The impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.6)

**Cut Slope:** The upslope, the hill sloping up from the roadbed.

**Debris Cone:** A mass of loose, unstable material constructed in part by mass movement (debris flows, debris torrents). Debris cones are typically associated with small, steep streams and have slopes greater than ten degrees.

**Debris Fence (U.S. Army Corps of Engineers (ACOE) Advanced Flood Protection Measure):** A debris fence may be constructed from a chain-link fence, continuous row of gabion baskets, logs chained or cabled to standing trees, or spaced gabion baskets. Debris fences prevent debris flow toward a structure.

**Decibel:** A unit of measure for sound intensity.

**Deposition / Storage Zone:** Areas of channel stability where the gradient of the river is relatively low and massive amounts of gravel and large wood are stored by the river. These are located near McGregor Meadows, Frog Island, and where the river meets Lake Chelan.

**Direct Effect or Impact:** Effects that are "…caused by the action and occur at the same time and place" (40 CFR 1508.8[a]).

**Ecosystem:** A geographically identifiable area that encompasses unique physical and biological characteristics. It includes the plant community, animal community and environment in a particular region or habitat.

**Effect (or Impact):** "Effects are synonymous with impacts" (40 CFR 1508.8[b]).

**Endangered Species:** A species listed by the U.S. Fish and Wildlife Service (USFWS) as in danger of extinction throughout all or a part of its range due to current or planned activity.

**Engineered Logjam:** As used by the NPS along the Stehekin River, an engineered logjam consists of several dozen large logs cabled together and anchored to the bank of the river. Some of the logs may be buried within the bank.

**Environmental Assessment (EA):** A public document, required under NEPA that identifies and analyzes actions that might affect the human environment, including natural, cultural and social resources. An Environmental Assessment provides sufficient evidence and analysis to determine whether an Environmental Impact Statement (EIS) is necessary. An EA facilitates compliance with NEPA when no EIS is necessary and facilitates preparation of an EIS if one is necessary.

**Environmental Impact Statement (EIS):** A public document, required under NEPA that identifies alternatives and analyzes their effects on the human environment.

**Environmentally Preferable Alternative:** The alternative in an EA or EIS that best promotes the goals of NEPA and meets the identified CEQ criteria. In general, this is the alternative that causes the least damage to the environment and best protects natural, cultural, and social resources.

**Exotic:** See nonnative.

**Facilities:** Buildings and the associated supported infrastructure, including roads, trails, and utilities.

**Finding of No Significant Impact (FONSI):** The decision document for an environmental assessment.

**Fill slope:** Downslope; the hill sloping down from the roadbed where fill from the construction of the road was cast.

**Floodplain:** The area surrounding a stream subject to flooding on some interval (10, 20, 50, 100, 500 years).

**Flow Deflector (ACOE Advanced Flood Protection Measure):** A barrier intended to divert, but not stop, flow toward a structure. Flow deflectors are located at an angle, a minimum of 20 feet from a structure.

**For Seasonal, Recreational, or Occasional Use (US Census Bureau measurement):** "Vacant units used or intended for use only in certain seasons or for weekends or other occasional use throughout the year. Seasonal units include those used for summer or winter sports or recreation, such as beach cottages and hunting cabins. Seasonal units also may include quarters for such workers as herders and loggers. Interval ownership units, sometimes called shared-ownership or time-sharing condominiums, also are included here" (U.S. Census Bureau 2011).

**Gabion Basket (ACOE Advanced Flood Protection Measure):** A gabion basket is made of steel mesh and contains various sizes of rocks that lock together well. Typical baskets are 3 feet wide by 3 feet tall by 6 feet long and may be wired together to achieve any desired length.

**Glide:** An expanse of shallow bottom extending across a streambed, over which the water flows smoothly.

**Grade Control (ACOE Advanced Flood Protection Measure):** Grade-control structures slow the progression of head cutting in areas where there is water flowing down a slope. Grade-control structures are trenches dug approximately 6 feet deep and filled with rip-rap.

**Gradient:** Degree of inclination of the part of the earth's surface; steepness of slope. May be expressed as a fraction, ratio, percentage, or angle.

**Guardwall:** A wall intended to keep cars on the road in case of loss of control.

**Headwall:** A vertical support structure at a culvert inlet or outlet.

**Historic or Cultural Resources:** Under NEPA/CEQ, these are culturally valued pieces of real property that are not historic properties and nontangible values such as cultural use of the biophysical and built environment, and sociocultural attributes such as social cohesion, social institutions, lifeways, religious practice, and other institutions.

**Historic Property:** Under the National Historic Preservation Act and NEPA/CEQ, a historic property is a district, site, building, structure, or object that is included in or eligible for listing in the National Register of Historic Places, and/or which includes resources of cultural and religious significance for American Indians (traditional cultural properties; see National Register Bulletin 38).

**Human Environment:** The natural and physical (e.g., built) environment and the relationships of people to that environment, i.e., social and cultural aspects and the relationships between natural and cultural. Culturally valued aspects of the environment generally include National Register historic properties, and other culturally valued pieces of real property, cultural use of the biophysical environment, and intangible sociocultural attributes as social cohesion, social institutions, lifeways, religious practices, and other cultural institutions.

**Housing Unit (US Census Bureau measurement):** "A house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Separate living quarters are those in which the occupants live and eat separately from any other persons in the building and which have direct access from the outside of the building or through a common hall" (U.S. Census Bureau, State and County QuickFacts)

**Igneous:** A type of rock formed as a result of volcanic processes.

**Impact (or Effect):** "Effects are synonymous with impacts" (40 CFR 1508.8[b]).

**Impairment:** Impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including opportunities that would otherwise be present for the enjoyment of those resources or values.

**Indirect Effect or Impact:** Effects that are caused by the action that occur later in time or at a distance from the action.

**Inlet:** The place where water enters a culvert or other drainage feature.

**Invasive Species:** A nonnative species of plant or wildlife that not only exists away from its natural habitat but also employs habits that allow it to take over the habitat, displacing native species. Often (in the case of plants) becomes a monoculture.

**Lacustrine:** Pertaining to wetlands and deepwater habitats produced by or formed in a lake.

**Land Protection Techniques:** Land use protection techniques detailed in the Land Protection Plan include agreements (cooperative and overlay district), zoning and public review, and regulations.

**Land Acquisition Methods:**

*Donation:* Landowners may donate property or interests in land to achieve conservation objectives. Tax benefits are also available for donations.

*Exchange:* The NPS will consider some federal lands within the authorized boundary as potential for exchange to strengthen historic development patterns, consolidate new developments into the most suitable areas, and protect other significant areas.

*Purchase:* Acquisition by purchase requires appropriated funds from Congress or donated from private sources.

*Purchase and Sellback:* Land is purchased in fee, appropriate restrictions are attached to the deed, and the deed-restricted land is then sold or leased to another owner.

**Lateral Moraine:** A low ridge-like moraine carried on, or deposited at, the side of a mountain glacier. It is composed chiefly of rock fragments loosened from the valley walls by glacial abrasion and plucking, or fallen on the ice from the bordering slopes.

**Left Bank:** The left side of a river when facing downstream.

**Main Channel:** The channel currently occupied by the main body of a river.

**Metamorphic:** A type of rock formed under tremendous heat and pressure.

**Mitigation:** Activities that avoid, reduce the severity of, or eliminate an adverse environmental impact.

**National Environmental Policy Act (NEPA):** The federal act requiring the development of an environmental assessment or environmental impact statement for federal actions having an effect on the human environment.

**National Register of Historic Places:** The National Register of Historic Places is the official list of American cultural resources worthy of preservation. Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. Properties listed on or "determined eligible" for listing on the National Register must be given consideration for preservation in the planning for federal or federally assisted projects.

**Native:** Indigenous; pertains to plant and animal species that occur naturally in a particular area. Not introduced by humans or as a result of human activity.

**No Action Alternative:** The alternative that is proposed to continue current management actions and direction. "No Action" means the proposed activity would not take place. The No Action Alternative sets the standards for comparing the action alternatives.

**Nonnative:** Exotic; pertains to plant or animal species that do not occur naturally in a particular area and were introduced by humans or human activity. These species may interfere with natural biological systems or ecosystems. Some nonnative species are also invasive. See invasive species.

**Organic Act (NPS) 1916:** The NPS Organic Act established the NPS to "promote and regulate the use of the parks" and defined their purpose as "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

**Outlet:** The location where water exits a culvert or other drainage feature.

**Owner-Occupancy (US Census Bureau measurement):** "A housing unit is owner-occupied if the owner or co-owner lives in the unit, even if it is mortgaged or not fully paid for" (U.S. Census Bureau, State and County Quick Facts). Owner-Occupancy Rate is equal to the number of owner-occupied housing units divided by the total number of occupied housing units in the geographic area.

**Palustrine:** Pertaining to freshwater wetlands dominated by trees, shrubs, persistent emergents, and emergent mosses and lichens. Also includes wetlands lacking such vegetation, but with the following three characteristics: area less than 20 acres; active wave-formed or bedrock shoreline features lacking; and maximum water depth less than 2 meters at low water.

**Planning:** An interdisciplinary process for developing short- and long-term goals and alternatives for visitor experience, resource conditions, projects, facility type and placement, and other proposed actions.

**Pool:** Deep sections of a river channel, usually between riffles, with gradients usually under 1 percent; critical habitat for river life during storm events.

**Preferred Alternative:** The alternative in an EA or EIS that the agency believes would best fulfill the purpose and need for action.

**Public Comment Process:** A formalized process required by NEPA in which the action agency publishes a notice in the Federal Register that provides notice that the agency is preparing an EIS. Public meetings are a required part of the EIS process. For EAs, the public comments process is less formal, with notification of the public by press release and optional public meetings.

**Pullout (Turnout):** A widened section of roadway that allows vehicles to pull off the road for viewpoints, access to terrain or emergencies. Pullouts may be formal (paved or graveled) or user-designated (created by visitor use over time).

**Reach:** The length of a stream channel that is uniform with respect to discharge, depth, area, and slope; also the length of a stream between two defined stations.

**Redd:** The depression a female fish creates when laying eggs that males then fill in with gravel.

**Retaining Wall:** A wall intended to hold the fill slope at a steep angle.

**Riffle:** An expanse of shallow bottom extending across a streambed, where water flows over submerged obstructions; a shallow rapids of comparatively little fall. Gradients are usually between 1 and 3.5 percent.

**Right Bank:** The right side of a river when facing downstream.

**Ring Dike (ACOE Advanced Flood Protection Measure):** An arc or circular structure made of sandbags constructed approximately 8 feet away from the structure to be protected. Ring dikes protect against a 1-foot rise in standing water and may be used in combination with pumping water out of the ring. Ring dikes are not suitable for use with moving water.

**Riparian Area or Zone:** The land area and associated vegetation bordering a stream or river.

**Rip-rap:** A layer of durable broken rocks or formed concrete selected and graded (in the same size), put together irregularly or fitted to prevent water erosion; often placed at the end of a constructed water flow zone, such as a culvert.

**Riverine:** Freshwater wetlands and deepwater habitats contained within a stream channel.

**Road Prism:** The area affected by original construction, from cut slope to fill slope.

**Rock Barb:** A structure that protrudes into the river at an angle upstream of perpendicular to the bank. Rock barbs are individually placed to redirect and dissipate the force of the river to create eddies, thereby eliminating bank erosion. Rock barbs are designed to move the main channel to the ends of the barbs away from the banks.

**Setback:** A line some distance from a specific site or area where areas beyond the line would be suitable for development or another activity.

**Scoping:** Public involvement is a key component of the NEPA process. In this part of the process, the general public, federal, state, local agencies and organizations are provided an opportunity to identify concerns and issues regarding the potential effects of proposed federal actions. The opportunity to provide input is called "scoping.".

**Scour Protection (ACOE Advanced Flood Protection Measure):** Scour protection structures consist of a long, narrow mound of rock and soil called a berm. Berms are used where water rises and flows across the property toward structures and where there is not a great deal of debris expected.

**Section 7 Consultation:** Section 7 of the Endangered Species Act requires federal agencies, when proposing a federal action to obtain a species list for the project area from, and to consult with the USFWS regarding potential impacts to listed species from the proposed action.

**Side Channel:** Channels peripheral to the main channel that may or may not have flowing water in them at all times. Can also be old, abandoned main channels.

**Sinuosity:** A quantifiable value to measure the degree to which a river channel meanders.

**Storage Zone:** See Deposition Zone.

**Substrate:** The substance or nutrient on or in which an organism lives and grows, or the surface to which a fixed organism is attached.

**Threatened or Endangered Species:** Plants or animals that receive special protection under federal or state laws, including the Endangered Species Act. Species may be listed threatened or endangered in the state, but not by the federal government (USFWS), or vice versa. Some USFWS regional offices also maintain a list of those species of special concern, either nationally or locally, which may be being or may have been previously considered for listing as threatened or endangered.

**Threatened Species:** Any species that is likely to become endangered within the foreseeable future throughout all or a part of its range, as listed by the USFWS in the Federal Register.

**Traditional Cultural Resource:** Any site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

**Traditional Cultural Property:** Traditional cultural resources eligible for or listed on the National Register of Historic Places. They are resources to which American Indian tribes attach cultural or religious significance and may include structures, objects, districts, geological and geographical features, and archeology.

**Transport Zone:** Reaches of the lower Stehekin River that have relatively straight, stable channels that move large wood and gravel between deposition reaches. They are generally located where the river flows against gravel deposited by the tributaries of Company, Boulder, and Rainbow Creeks.

**Turbidity:** A measure of the optical clarity of a liquid (water). Optical clarity in water is affected by the scattering and absorption of light by suspended material, such as clay, silt, sand, and organic and inorganic particulates and plankton.

**Turnout:** See Pullout.

**U.S. Fish and Wildlife Service (USFWS):** The federal agency responsible for implementing the provisions of the Endangered Species Act, including listing species, developing recovery plans, etc.

**Vacant Housing Unit (US Census Bureau measurement):** "A housing unit [where] no one is living in it at the time of enumeration, unless its occupants are only temporarily absent. Units temporarily occupied at the time of enumeration entirely by people who have a usual residence elsewhere are also classified as vacant" (U.S. Census Bureau 2011).

**Viewshed:** The visible areas seen from identified viewpoints.

**Visitor Experience:** The perceptions, feelings, reactions, and activities of a park visitor in relationship to the surrounding environment.

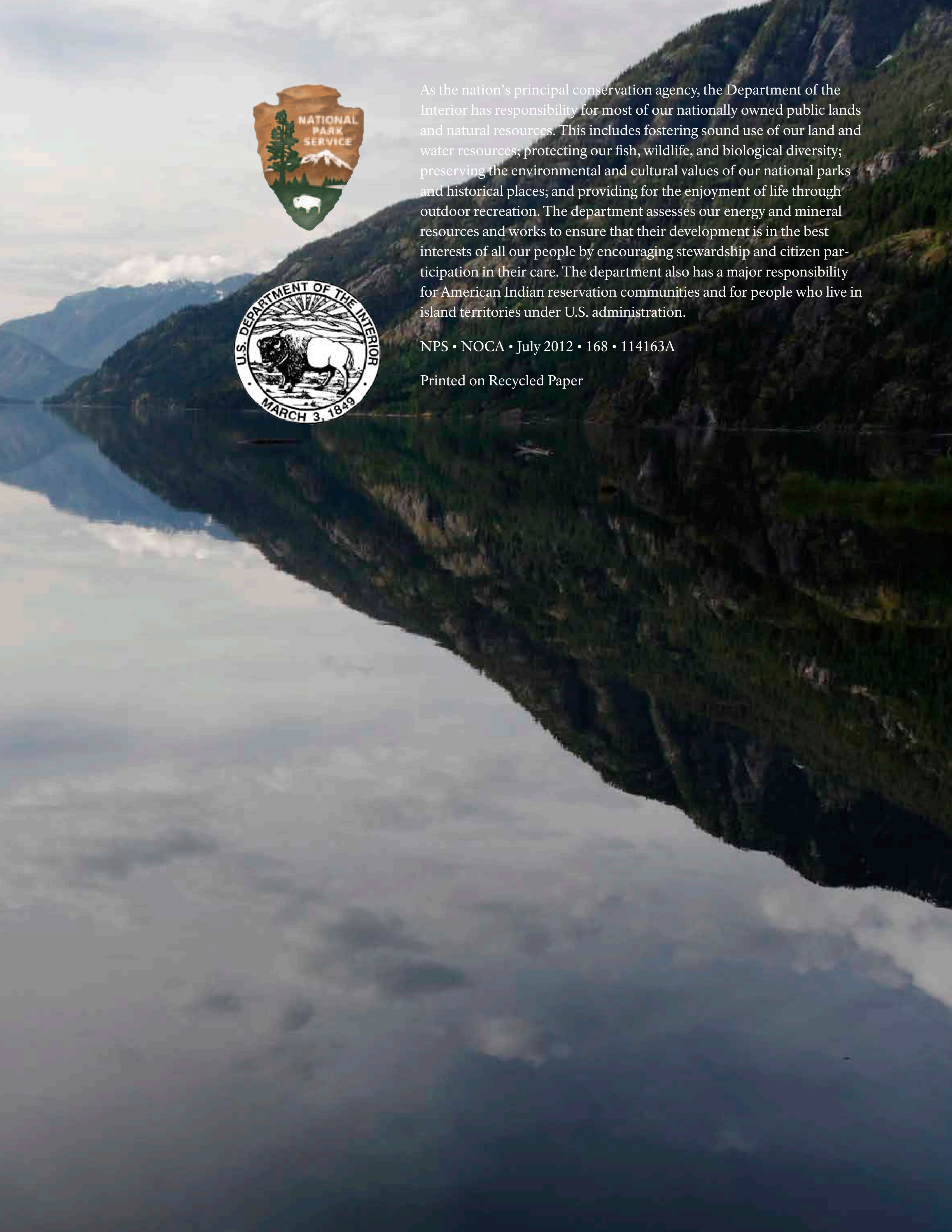
**Visitor Use:** The types of recreation activities engaged in by visitors, including the type of activity, visitor behavior, timing, and distribution of use.

**Wetland:** As defined by the ACOE – an area inundated or saturated with surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

## B. ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACHP | Advisory Council on Historic Preservation |
| ACOE | U.S. Army Corps of Engineers |
| AFMZ | Alluvial Fan Migration Zone |
| amsl | above mean sea level |
| APE | area of potential effects |
| ARPA | Archeological Resources Protection Act |
| BLM | Bureau of Land Management |
| BMP | best management practice |
| CAA | Clean Air Act |
| CCRs | Conditions, Covenants, and Deed Restrictions |
| CEQ | President's Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| Chelan PUD | Chelan County Public Utility District |
| CMZ | Channel Migration Zone |
| Complex | North Cascades National Park Service Complex (North Cascades National Park, Ross Lake National Recreation Area, and Lake Chelan National Recreation Area) |
| CTA | Common to All |
| CWA | Clean Water Act |
| dbh | Diameter-at-Breast-Height (a standard measure of tree size) |
| DCA | Designated Conservation Area |
| DEIS | draft environmental impact statement |
| EA | environmental assessment |
| EIS | environmental impact statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| $ft^2$ | square feet |
| $ft^3$ | cubic feet |
| FEIS | Final Environmental Impact Statement |
| FEMA | Federal Disaster Assistance Administration |
| FERC | Federal Energy Regulatory Commission |
| FHWA | Federal Highway Administration |
| FONSI | Finding of No Significant Impact |
| GMP | General Management Plan |
| HAER | Historic American Engineering Record |
| $km^2$ | square kilometers |
| Lake Chelan NRA | Lake Chelan National Recreation Area |
| LEED | Leadership in Energy and Environmental Design |

| | |
|---|---|
| LPP | Land Protection Plan |
| nd | no date |
| N/A | Not applicable |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NOAA Fisheries | National Oceanic and Atmospheric Administration, National Marine Fisheries Service |
| NOCA | North Cascades National Park |
| NPS | National Park Service |
| NR | National Register (of Historic Places) Number |
| NRA | National Recreation Area |
| PEPC | NPS Planning Environment and Public Comment website |
| PL | Public Law |
| SHPO | State Historic Preservation Office or Officer |
| USC | United States Code |
| USDA | United States Department of Agriculture |
| USFWS | U.S. Fish and Wildlife Service |
| USFS | USDA Forest Service |
| USGS | United States Geological Survey |
| VOC | Volatile Organic Compound |
| WDFW | Washington Department of Fish and Wildlife |
| WSRA | Wild and Scenic Rivers Act |
| $yd^3$ | cubic yard |



As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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**U.S. Department of the Interior**

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